A Study on Jordanian Commercial Banking – An Empirical Investigation on the Effects of Liquidity Risk, Risk-Based Capital Requirements and Capital Regulations

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April 2021

The thesis is submitted in partial fulfillment of the requirements for the award of the degree of Doctor of Philosophy in Economics and Finance from the University of Portsmouth.

ABSTRACT

The research contained in this thesis investigates the main determinants of Jordanian bank performance and related issues covering liquidity risk, risk-based capital requirements and capital regulations using data for 13 Jordanian commercial banks covering the period 2003-2015. This period includes measures taken by policy makers, including the Central Bank of Jordan (CBJ), to liberalize and reform the Jordanian banking sector to improve bank performance. The thesis is structured as follows: chapter one introduces the subject matter of the thesis; chapter two provides a select survey of the literature. Chapter three briefly discusses developments in the Jordanian banking sector, including the reform measures since the 1990s. Chapters four, five, six and seven are the core empirical chapters of the thesis. Chapter four examines the impact of competition, liquidity risk and market interest rate environment on Jordanian banks' profitability using Fixed Effects (FE), Random Effects (RE) and Generalized Method of Moments (GMM) methods. The findings of chapter four provide evidence that reform policies favored the overall profitability and efficiency of the Jordanian banking sector. However, the evidence suggests the need for improvements in bank competition. Liquidity risk is shown to have a significant positive impact on profitability, while the banks' size, capital adequacy ratio, and equity to assets all reduce profitability measures. Chapter five examines the relationship between bank efficiency/productivity, capital, and risk using Three-Stage Least Square (3SLS) methods. The results show that return on assets (ROA), capital, size and stock market development (SMD) are essential for Jordanian banks' efficiency and risk measures. Chapter six measures how competition and efficiency of the banking sector influence the cost of credit for borrowing firms using data from 118 firms using fixed effect and random effect method. The findings indicate that firm size, bank competition, and GDP are the main drivers of firms borrowing costs. Chapter seven studies the impact of bank funding liquidity risk on Jordanian commercial banks' risk-taking behavior and analyses the impact of the CBJ 2000 imposed deposit insurance scheme on Jordanian banks' liquidity creation using a FE, a RE and difference in difference methods (DD). In relation to the risk determinants, the results show that large-capitalized banks tend to be involved in riskier investment decisions than their less capitalized counterparts. Also, an increase in deposit funding increases both liquidity creation and risk-weighted assets. The difference in differences results indicates that after the introduction of the deposit insurance scheme, banks with excessive deposits have lower rates of liquidity funding risk, and consequently reduced probability to default.

ACKNOWLEDGEMENTS

First, I must thank God as nothing is achievable in my life without god. I would also like to express my considerable gratitude to my principal advisor, Dr. Everton Dockery, for his guidance, support, and the time he has devoted to me during the development of the present study. He generously spent innumerable hours designing my reading, reading many incomplete drafts, providing several comments and suggestions, and encouraging my research. Without his advice and encouragement over the four years, I have worked on this thesis, the subject matter of the thesis would never have happened. The final product has benefited in all respects from his guidance and I cannot overstate my gratitude. I have been extremely fortunate to have him as my advisor.

For my Ph.D. study, without the support and love that my family (parents, brothers, sisters friends and husband) has provided me would not have been possible. To my parents whom I cannot thank adequately enough for their patient care and love, to my brothers and sisters for their encouragement, continuous support and help. To my husband who support me to finish the viva in a relax mind. Unfortunately, during the final stages of my Ph.D., my mother passed away to which I also dedicate this achievement to her. I would like to acknowledge those I came in contact with while completing this body of work to support me when I experienced stressful and some difficult periods.

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DECLARATION

"Whilst registered as a candidate for the above degree, I have not been registered for any other research award. The results and conclusions embodied in this thesis are the work of the named candidate and have not been submitted for any other academic award."

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Word Count: 82149

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LIST OF ABBREVIATIONS

- ABJ – Association of Banks in Jordan
- ASE – Amman Stock Exchange BHC – Bank Holding Company
- ATM – Automated Teller Machine.
- BCBS – Basel Committee on Banking Supervision
- CAP – Total Capital
- CBJ – Central Bank of Jordan
- CD – Certificates of Deposit
- CEE – Central and Eastern European
- CIN – Cost-to-Income Ratio
- CR – Concentration Ratio
- DEA – Data Envelopment Analysis
- DID – Difference-in-Difference Approach
- DMU – Decision Making Unit
- ECB – European Central Bank
- EU – European Union
- EVA – Economic Value Added
- FE – Fixed Effect
- FED – Federal Reserve
- GDP – Gross domestic product
- GLS – Generalised least squares model
- GMM – General Method of Moments
- HHI – Herfindahl–Hirschman Index

- IAS – International Accounting Standard
- IMF – International Monetary Fund
- INF – Inflation
- IV – Instrumental Variable
- JD – Jordanian Dinar
- JDIC – Jordanian Deposit Insurance Corporation
- JODIBOR – Interbank Lending Interest Rates
- LC – Liquidity Creation
- LTD – Loan-to-Deposit Ratio
- LGMM – Local Generalized Method of Moments
- MENA – Middle East and North Africa
- MPI – Malmquist Productivity Index
- MS – Market Share
- NIM – Net interest margin
- NPL – non-performing loans
- NS – Non-Structural Model
- OECD – Organisation for Economic Co-operation and Development
- OLS – Ordinary least squares model
- Q – Tobin's Q Ratio
- RE – Random Effects
- REPO – Repurchase Agreement Rate
- ROA – Return on assets
- ROE – Return on equity
- RWA – Risk Weights of Assets

- SCP – Structure Conduct Performance Hypothesis
- SEC – Securities Exchange Commission
- SEE – South Eastern European
- SSA – Sub-Saharan Africa countries
- SUR – Seemingly unrelated regression model
- TA – Total Assets
- UK – The United Kingdom
- US – the United State of America
- WB – World Bank
- WTO – World Trade Organization
- 3SLS – Three-Stage Least Squares
- 2SLS – Two-Stages Least Square

CHAPTER 1

Introduction

1.1 Research background and motivation to the study of Commercial Banking in Jordan

The global financial crisis of 2007-2010 impacted the world economy in many ways, including deep financial losses in asset value, bankruptcies, and the rethinking of regulation applied to international financial markets and institutions. The global financial crisis that originated in the United States of America (USA), because of subprime lending had a global impact and spillover into Jordan. This indicates that the USA's financial sector problems can significantly impact the real economy of a developing country such as Jordan. In the immediate onset of the 2008 crisis, the central banks have immediately affected the governments and regulators devised by measures designed to stabilize their financial systems and in particularly the banking sector. Central bankers aimed to protect the financial institutions and, in particular, the banks, against potential risks and economic shocks , to safeguard the economies and provide signal to international financial markets and the global economy. Those careful and thoughtful measures were being taken to safeguard the international financial system and to ensure the continued growth and development of the global economy. It is recognized that the performance of financial sector is very sensitive to changes the business cycle (Smirlock, 1985, Berger and DeYoung, 1997b), inflation (Molyneux and Thornton, 1992, Demirguc-Kunt and Levine, 2000), as well as the interest rate environment (Bourke, 1989).

Particularly the banking sectors are driven by internal and external factors. Internal factors are those related to bank-specific characteristics such as size, capital, liquidity, risk, and capital requirements. In contrast, external factors are associated with the extrinsic legal and economic environments governing the banking industry. As a developing country exposed to global shocks, Jordan's economy was not protected from the severity of economic and financial shocks. Jordan has been confronting several shocks, including the global financial crisis and the Arab Spring since 2007. It also had a severe dampening effect on the domestic economy. The imposition of a tight fiscal policy that followed these crises is accompanied by prudent monetary policy (which was accompanied by several cuts in interest rates in 2007-2010) from

the Central Bank of Jordan (CBJ). It helped in some ways to maintain the economic and monetary stability to sustain growth rates, high levels of reserves and price stability. While financial stability was maintained by the CBJ via the application of prudent supervisory and legislative policy. It may be argued to consistent with the policy measures imposed by the G7 countries central banks. Besides the imposition of these measures, the management of the banking system in the aftermath of global banking crisis contributed towards protecting the financial system against the recurrence of a crisis, given that the banking system is relatively conservative in its approach to banking, with high levels of capital and low exposure to sovereign euro denominated debt.

Since 1948 Jordan's banking sector has been one of the strongest performing sectors of the Jordanian economy. Therefore, it's given a special role in Jordan's financial system, the banking sector has played an active role in terms of development and growth of the economy, in the provision of credit facilities for the household and business sectors which enabled the economy to continue on an upward trajectory growth trend. Currently, the number of banks in Jordan stands at 25 banks are engaged in the conventional banking business. In 1934 only 2 banks were operating in Jordan, but increased to five by 1955. During the 1990s, 25 banks operated in Jordan's banking sector, thirteen engaged in commercial banking activities, three in Islamic banking activity, and nine are foreign commercial banks. Commercial banks provide customers with various services (modern and traditional) such as accepting deposits and granting credit to households, businesses and other outlets. Other income-generating activities include the provision of credit card, economic and financial consulting, bill collection, and financing government development and economic plans. Deposits are the most important sources of funds for these banks who are Islamic banks aside. They generate the majority of their earnings (or profits) from the spread rate, which is the difference between the debt interest and credit interest.

In 2003, Jordanian banks conducted their banking operations through a network of 581 branches and 158 representative offices, compared to 786 branches and 83 representative offices in 2015. The banking sector is a key sector of the Jordanian economy which is accounted in 2015 for 18.82 percent of Gross Domestic Product (GDP) compared to 3.85 percent of GDP in 2003. It its widely considered a profitable sector for local and foreign investors with a return on assets (ROA) of 1.3 per cent in 2015 compared to 0.07 per cent in 2003, and return on equity (ROE) of 10.3 percent in 2015 compared to 9.9 percent in 2003.

The primary source of income for Jordanian banks is the Interest yield from loans with interest margins accounting for around 77.4 per cent of total banks income in 2015 compared to 63.7 percent in 2003.

Despite the political and economic risks in the Middle East and North Africa region (MENA), the banking system in Jordan provided stability due to resilience and the soundness of its financial position that continued to improve and demonstrated the robust nature of the banking sector. As a result, the banking sector has been an integral source of support to the economy during periods of economic uncertainty. Furthermore, aided by the CBJ pro-growth monetary stance, which followed from the growth in deposits and profits at commercial banks during the period represented by the data used in the present study, the banking sector continued to post healthy performance.

Historically, monetary policy in Jordan has evolved over two stages. The first stage in 1964-1990, is characterized by the use of direct and traditional monetary instruments such as setting of interest rates to control banks operations, while the second stage from 1991-to the present was largely influenced by the banking crisis of 1989 which as a result of its impact on the Jordanian economy compelled the government to co-operate with the World Bank and the IMF to develop a structural reform program so as to enable to restructure and rebuild the economy in the aftermath of the crisis. One of the main goals of the structural reform program was to improve the structure and efficiency of Jordanian banks which was enabled because of measures designed to liberalize the banking system.

Prior to the 1980s banking in Jordan was dominated by domestic banks as foreign banks found it extremely difficult to penetrate the domestic banking market and it is a large degree helped to insulate the local banking market from foreign competition. Thus, Jordanian commercial banks operated in an oligopolistic environment which meant that interest rates on both credits and deposits were determined monopolistically. Over the period of 1988–1991 following the devaluation of Jordanian Dinar (JD) the CBJ increased interest rates as a way of incentivizing Jordanian citizens to save. But as a result of the financial difficulties, combined with the collapse of Petra Bank and six other financial institutions linked to it. The banking system suffered by crisis which came from climaxed in August 1989 as a result of inadequate banking regulations which ignored widespread fraud in the banking sector. Moreover, since the level of market abuse had reached a level such that it could no longer go unnoticed. The CBJ was forced to implement measures which one are compelled the Jordanian banks to

comply with operating ratios while imposing credit limits also. It would force the banks to carryout proper risk credit analysis on all loan advances. The second reason is the high level of Non-performing loans (NPL) resulting from the overexposure of the banks to the real estate market. And finally, the speculative activity of banks in the foreign exchange market was exposed by many banks to excessive foreign exchange exposure.

From the early 1990s to onward the CBJ implemented a series of measures designed to facilitate the deregulation of the Jordanian financial system. One of the key policy measures was the removal of restrictions on interest rates to help promote a diversified, efficient, and competitive banking system, as it was thought that the operational flexibility of the banks was one way of increasing their competitiveness. Following these measures, the interest rate margins increased at Jordanian banks and the CBJ adopted a floating policy for both debit and credit markets interest rate. Another crucial policy change was the decision to allow market forces to set market interest rates. While the decision to remove restrictions on investment activities had favourable effect on all the important indicators of bank performance.

During the period of 2003-2015, most of these indicators are reflected by a significant improvement in assets quality, profitability and efficiency of the Jordanian banking sector. However, it is worth noting that the financial crises had temporary and mitigating effect on the development of these indicators, especially during the period represented by the global banking and financial crisis of 2008 to 2010. Table 1.1 shows the development of selected bank indicators over the period 2003 to 2015.

Table 1 1 Selected bank indicators 2003-2015.

Year	**Return on Equity (ROE)**	**Return on Assets (ROA)**	**Interest Margin to Gross Income**
2003	9.9%	0.7%	63.7%
2004	13.1%	1.1%	58.3%
2005	20.9%	2.0%	56.4%
2006	15.0%	1.7%	70.2%
2007	12.6%	1.6%	66.7%
2008	11.5%	1.4%	71.3%
2009	8.8%	1.1%	71.6%
2010	8.8%	1.1%	74.3%
2011	8.3%	1.1%	70.1%
2012	8.6%	1.1%	76.6%
2013	9.9%	1.2%	77.6%

2014	11.1%	1.4%	77.9%
2015	10.3	1.3%	77.4%

Source: CBJ Database 2003-2015

Bank managers usually face difficult choices to secure high returns for their shareholders while keeping risks under control. These excessive risk intentions are then controlled by the CBJ regulatory measures which are designed to maintain the stability of the banking system. Following the CBJ reforms which created a low-interest-rate environment in an effort to stimulate lending and the channeling of funds for the development of the economy, the Jordanian Deposit Insurance Corporation (JDIC) was established in 2000s as a part of the reform programs to protect deposit-taking institutions against potential internal and external shocks. In addition, the CBJ also encouraged the integration of risk management policies in banking operations to enhance the safety and soundness of banks and to strengthen the financial system as a whole. The imposition of stress testing exercises in all banks was seen as a necessary requirement following the Basel Committee on Banking Supervision (BCBS) announcement in 2009. A bank's stress test is one conducted under various hypothetical scenarios for example, an economic recession, a crisis in financial markets, or external shocks, designed to determine whether a bank is adequately capitalized to withstand the effects of any adverse economic development that would ultimately impair a bank's balance sheet.

The 2008 global financial crises on the Jordanian economy were largely felt in the real sector of the economy. This was due in part to the country's high dependence on imported food and oil and the cost of external finance which became more difficult and expensive to access, causing shareholders in Jordan to value cash at a premium since the crisis (Ahid and Augustine, 2012). As a result, the profitability of the banking sector was deeply affected. In a study by (Ahid and Augustine, 2012) on Jordanian banking. The authors split the post-financial crisis period in Jordan into two stages. The first stage extends from April 2008 to December 2008 and the second stage runs from the period 2008 – 2011. The findings note that during the first period, the impact of the crises was driven by the downturn in the values of grants from developed and international donors who were adversely affected by the crises. The response of the CBJ was to apply measures to protect the banking sector to ensure its bank stability against the crises. One such measure was the imposition of strict loan classification to reduce unnecessary exposure, with interest rate set at 10.5 percent for housing loans.

Despite such measures, many depositors withdrew their savings in large amounts which

led to a decline in the number of deposits in foreign currency from 5370.1 million JD in 2007 to 4754.1 million JD in 2008. However, confidence in the stability of Jordanian banks was restored when the government declared that it would fully guarantee all bank deposits. To prevent a further run-on Jordanian banks, the CBJ required the banks to increase their capital (both in JD and foreign currency) to cover any potential liquidity shortages. The CBJ also decreed that the banks should stress test conditions against liquidity levels. And following the widespread imposition of Basel III, stress testing became one of the main tools applied by banks in their effort to withstand regional and global shocks and thereby hedge against potential risky positions. According to the CBJ the results of these tests are not only helped in determining the required level of capital and liquidity but also protected the banking system.

To strengthen the solvency of banks and their ability to face banking risk with some degree of confidence. In 2000 the CBJ amended the 2000 law regarding the minimum capital of licensed banks. In this respect the CBJ raised the minimum capital of banks to 100 million JDs for Jordanian banks and 50 million JD for branches of foreign banks. In 2011, the CBJ amended the 1971 Act with respect to medium-term grants of licensed banks to increase bank lending to the real sectors of the economy to boost economic growth and the economy following the recession. In 2012 the CBJ updated the operational framework for monetary policy to steer the level of bank reserves surplus and interest rate lending between banks. In a move that would help to make Jordanian banks more flexible with respect to bank liquidity management, the CBJ continued to apply the corridor system within the operational framework for monetary policy whereby the CBJ sets the floor and ceiling of policy rate while at the same time allowing other money market rates such as the interbank rate to wander within this floor and ceiling.

On the regulatory front in 2013 the CBJ updated many instructions in the field of banking supervision and regulation and 2014 issued a number of instructions related to corporate governance and the role of audit committee in the branches of foreign banks operating in the banking sector of Jordan. Other policy measures that had a calming effect on the banking crises were the government’s guarantee of all bank deposits until the end of December 2009, which helped to re-establish investors trust as earlier noted. During this period the CBJ cut interest rates three times until April 2009, thus bringing the benchmark rate to 5.25 percent. In an effort to enhance bank liquidity the CBJ reduced banks' reserve requirements from 10 percent to 7 percent in October 2008 (European Commission, 2010).

The importance of the study is to investigate the impact of the reform program, Arab Spring, Global Financial Crises and the Basel I, II, and III on the Jordanian commercial banks during the 2003 and 2015 as the Jordanian market faced a huge event affected the banking sector directly as mentioned above. The research studied of 13 Jordanian commercial banks that are listed in Amman Stock Exchange which they present 94% of the Jordanian banking system assets, the minimum CAR of the CBJ is 12% and the Jordanian commercial banks CAR reached 21% which give the importance to study the impact of the high CAR on the bank performance and the risk-taking behavior. The research examines eleven hypotheses covering four empirical topics that investigated the factors which affecting the Jordanian commercial banks performance, competition, efficiency, capital and risk-taking behavior, which they are trend areas needs to study especially after the Global financial crises 2008. One of the main reasons behind this investigation is the rare of the studies that examined the same topic in the Middle East in general and especially in Jordan. Findings of the study takes it's important as it give and highlight the impact of the new capital requirement regulations, liquidity risk and risk-based capital regulation on the Jordanian commercial banks which directly may help the CBJ regulators to take the right and logical decision to improve and enhance the sector. It is helping the banks manager as well to take the right decision in order to minimize the banks risks. The study results have its main impact on the soundness and the safety of the Jordanian banking system as the policy maker can see the impact of the reform, liberalization and deregulation policy they did adopt on the banking system which give them a sight of the efficient of the adopted policy.

The study only focused on one aspect of banking sector indicators which is a risk and overlooked indicators related to productivity, efficiency and profitability. Thus, there is a need for a comprehensive empirical assessment of the impact of the recent CBJ reforms on performance, risk and efficiency indicators. This research is the first of its kind to cover an extended time span from 2003 until 2015 while considering the effects of some major incidences namely the 2008 global financial crises, Basel II and III accords announcements and regional political shocks such as the Arab Spring in the Middle East area and especially Jordan which makes a direct contribution to the existing literature by filling this gap in the Middle East area. The study's importance may be important to examine it for the Palestine, Syrian, Iraq and Lebanon banking system as it will show the impact of immigration from those countries as a result of war on the banking system. The huge amount of money that moved to Jordan due to the huge number of refugees also has a huge impact on the banks' performance.

There is a considerable gap in the literature on banking performance indicators in Middle Eastern countries especially Jordan. And despite the reforms undertaken there have been few attempts to assess the impact of the reform program on the efficiency, profitability and risk behavior of the Jordanian banking sector. Most of the recent studies that have assessed the impact of the reform policies are qualitative such as (Al-Fayoumi and Abuzayed, 2009). While empirical studies such as (Maghyereh, 2008) ignored the significant effects of the 2008 financial crises on the CBJ reforms and bank indicators. Also, this study only assessed the impact of the reforms on a set of efficiency indicators. Another study by (Jarrah, 2010) examined the systematic, non-systematic, and total risk of Jordan's banking sector using data covering the period 2001-2009.

1.2 Research Objectives

In this section we will focus on the study objectives that have been developed over the years by researchers in banking and link the study hypotheses to the related economic theories and a stream of the previous literature. Based on the existing literature, the underlying objectives of this research are five-fold:

First to investigate the impact of bank-specific market structure, and macroeconomic variables on different profitability measures. Second, to measure the impact of competition, risk and the interest rate environment on the profitability and risk-taking behavior of Jordanian commercial banks. Third, to examine the relationship between bank efficiency, capital, and risk of Jordanian commercial banks. Fourth, to address how competition and efficiency of the banking sector influence the cost of credit for borrowing firms using data from 118 firms. And finally, to examine the impact of liquidity funding measures on the risk of Jordanian commercial banks and to assess the impact of the deposit insurance scheme applied in Jordan on the liquidity creation of Jordanian commercial banks. The period of our analysis covers 2003 to 2015 and our sample consists of 13 commercial banks operating in Jordan's banking sector.

The study seeks to answer the following research questions:

- How and in what ways have the competitive conditions affected by the profitability of Jordanian banks?

- Does liquidity risk influence the profitability of Jordanian banks?
- To what extent have changes in interest rates affected the profitability of Jordanian banks?
- Which market type monopoly, monopolistic competition or perfect competition, best represents the Jordanian banking sector?
- Does bank capital affect the risk-taking behavior of Jordanian banks?
- Does bank capital affect the efficiency of Jordanian banks?
- To what extent does risk affect the efficiency of Jordanian banks?
- Does bank size affect liquidity funding?
- Does capitalization affect the liquidity funding requirement of Jordanian banks?
- To what extent have crisis periods affected the liquidity funding requirements of Jordanian banks?
- Does the size of a bank affect its liquidity creation?
- Does bank capitalization affect liquidity creation?
- To what extent has crises periods affected the liquidity creation of Jordanian banks?

To reach the study objectives and questions, we examined the following hypothesis:

H1.1: There is a positive relationship between bank competition and profitability.

Given its importance in extending the literature for Jordanian banks, the empirical evidence offers some guidance in this respect. Only a few studies address the role of bank competition in relation to bank profitability. (Buchs and Mathiesen, 2005), for example, reveals that banking competition helps foster higher economic growth which leads to improving bank profitability. Also, (Petria et al., 2015); (Hsieh and Lee, 2010), (Coccorese, 2004) and (Demirguc-Kunt and Peria, 2010) found a positive impact of competition on bank profitability.

H1.2: There is a significant positive relationship between liquidity risk and profitability.

Because few studies have addressed the role of bank liquidity risk using Jordanian bank data, our second hypothesis holds out the prospect for finding such a relationship. Some prior studies such as (Arif and Nauman Anees, 2012) who examined the effect of liquidity risk on banks' profitability found a significant positive effect of liquidity risk on bank profitability. (Bourke, 1989) found evidence of a positive relationship between liquidity risk and bank profitability for 90 banks in Europe, North America, and Australia. (Naceur and Kandil, 2008) also found a positive significant influence of liquidity risk on financial profitability.

H1.3: There is a positive relationship between the interest rate and profitability.

To fill the literature gap of the impact of the interest rate on the Jordanian bank profitability especially after the liberalization, our empirical evidence offers some guidance in this respect. We hypothesized our third hypothesis. (Bourke, 1989) for example investigate the determinants of bank profitability, he found that interest rates are positively related to profitability. (Molyneux and Thornton, 1992) replicated (Bourke, 1989) study and found that interest rates have a significant positive association with bank profitability. (Genay and Podjasek, 2014) also, found that the low-interest-rate environment is associated with decreased profitability for banks. Similar findings were postulated by (Bikker and Vervliet, 2018) for all U.S. commercial and savings banks.

H2.1: There is a positive relationship between bank capital and efficiency.

Few studies address the relation of bank capital into bank efficiency of the Jordanian banks and as a result of its importance in extending the literature, we hypothesized our fourth hypothesis. (Kwan et al., 1997) for example, found that bank efficiency is affected by bank capital and they argued that banks with more capital operate more efficiently than banks with less capital. (Fiordelisi et al., 2011b) found that higher bank capital levels increase bank efficiency.

H2.2: There is a negative relationship between risk and bank efficiency.

Our fifth hypothesis addresses the relation of bank risk to the Jordanian banks' bank efficiency, which covers the gap in the literature of the Jordanian bank studies. (Fiordelisi et al., 2011b)

for example, found that inefficient banks typically have higher risk levels. Also, (Berger and De Young, 1997) and (Williams, 2004) suggest that declines in efficiency will temporarily lead to increases in banks' risk. (Jeitschko and Jeung, 2005) indicating that bank managers tend to take on more risk when the banks have lower levels of capital or the banks are less efficient.

H2.3: There is a negative relationship between capital and risk.

Studying the impact of the capital requirement regulation and the relationship between capital and risk of the Jordanian banks takes its important especially after implementing the requirements. we are extending the literature by hypothesized our sixth hypothesis. Several studies found that the incorrect design of capital requirements leads to excessive risk-taking behaviour by banks (Yehuda and Kahane, 1977, Kim and Santomero, 1988, and Koehn and Santomero, 1980). (Shrieves and Dahl, 1992), (Jacques and Nigro, 1997) and (Matejašák et al., 2009) all share the view that banks tend to adjust their capital ratio by increasing capital and decreasing their risk when the regulatory pressure increases. Empirical studies such as (Demsetz et al, 1997) and (Salas and Saurina, 2003) report a negative effect of capital on the levels of risk taken by banks. (Demsetz et al., 1996) and (Salas and Saurina, 2003) report a negative effect of capital on the levels of bank risk taken by banks.

H3.1: There is a negative relationship between bank efficiency and the cost of credit.

There is shortage of studies that address the relationship between Jordanian bank efficiency and the cost of credit. We are filling the gap by hypothesized our seventh hypothesis. (Shamshur and Weill, 2019) found that bank efficiency reduces the cost of credit, where improvements in bank efficiency tend to be strongly associated with a lower cost of credit. (Sapienza, 2002) note that efficient banks can offer borrowing firms' loans at lower costs than their less efficient competitors.

H4.1. Lower funding liquidity risk incentivises banks to take more risk.

The importance of extending the literature for the relationship between bank risk and bank funding liquidity risk. The empirical evidence offers some guidance in this respect, extending the few studies that address this relationship. Based on the theoretical insights of (Acharya and

Naqvi, 2012) and (Wagner, 2007), banks with higher deposits were characterized as having less funding liquidity risk, which then feeds into the bank risk-taking behaviour. (Jensen, 1986) found that banks with lower funding liquidity risk might be tempted to make poor investment decisions that increase bank risk-taking behaviour. (Acharya and Naqvi, 2012) found that banks have lower funding liquidity risk because of large amounts of deposit inflows, which leads bank managers to take more risk by aggressively lowering the lending rate to increase loan volumes to enhance their own compensation.

H4.2. Banks with higher capital buffers are less risk-taking in response to lower funding liquidity risks.

Given the importance of the capital requirement regulation, we are extending the literature for Jordanian banks by addressing the relationship between bank capital and bank risk-taking. (Konishi and Yasuda, 2004) for example found that the implementation of capital adequacy requirements has reduced risk-taking by commercial banks. Similarly, (Repullo, 2005) finds that bank risk-taking is negatively related to capital requirements. Empirical studies such as (Demsetz et al, 1997) and (Salas and Saurina, 2003) report a negative effect of capital on the levels of risk taken by banks.

H4.3. Larger banks take less risk in response to lower funding liquidity risk.

Only a few studies address the relationship between bank size and bank risk-taking of the Jordanian banks. Our hypothesis extending the literature for Jordanian banks which offers some guidance in this respect. Earlier on (Demsetz and Strahan, 1997) provided evidence that increases in banks' total assets reduce firm-specific risk. Similarly, larger banks take less risk as bank size increases banking stability as founded by (Mercieca et al., 2007) and (Stiroh, 2004). (Wagner, 2007) also notes that banking system instability increases with higher liquidity.

H4.4. In response to reductions in funding liquidity risk, bank risk decreased during the Global Financial Crisis.

Finally, and after the last global financial crises 2008, few studies address the relationship between bank risk and the global financial crises for Jordanian banks. In this aspect, we hypothesized our last hypothesis to offers some guidance in this respect. (Ivashina and Scharfstein, 2010) for example found that bank excessive lending behaviour during times of access to large deposit funding contributed to the triggering of the 2008 global financial crises.

In the next chapter (chapter 2) the study focuses on the theories related to that have been developed over the years by researchers in banking and related to the study objectives and hypotheses.

1.3 Research Method

Several econometric methodologies are implemented in this study to provide a rigorous and robust set of empirical evidence on the effects of liquidity risk, risk-based capital requirements and capital regulations on Jordanian banks.

Following the work of (Olalere, Bin Omar, & Kamil, 2017); (Sufian & Habibullah, 2009); (Nathan & Neave, 2016), we use the methods of Pooled OLS, Fixed Effects (FE), Random Effects (RE), and Generalized Methods of Moments (GMM) approaches to aid our research strategy in Chapter 4, that is the first empirical chapter. This chapter aims to empirically assess the impact of competition, liquidity risk, interest rate, bank profitability, and risk-taking behavior. We start our analysis by implementing the model of (Panzar and Rosse, 1987) which is based on a test statistic H, to assess the state of competition in the Jordanian banking sector. Since the H-statistic measures the elasticity of total revenues with respect to factor input prices and is calculated from a reduced-form bank revenue equation, it will allow us to gauge how a change in input prices is reflected in the equilibrium revenues earned by banks. Both the FE and RE methods are used to account for biasness in omitted variables that arise from ignoring the time-invariant characteristics that are correlated with the dependent variables and which cannot be accounted for. The GMM method is a dynamic modeling technique that permits the inclusion of lagged dependent variable as one of the right-hand side variables while accounting for the endogenous nature of some of the variables by replacing them with their lagged and lagged different values.

In chapter 5, we empirically examine whether there exists any relationship between bank efficiency and productivity, capital and risk in the Jordanian banking system. This chapter uses

the pooled OLS, FE and RE methods previously discussed in addition to the Three-Stage Least Square (3SLS) method which I use to estimate a system of equations that employ different risk indicators. This method has been used by (Tan and Floros, 2013) and (Rime, 2001). 3SLS is a remedy for the problem of endogeneity between bank efficiency, risk and capital. It should be noted that 3SLS estimates systems of structural equations where some equations contain endogenous variables among the list of explanatory variables. These endogenous variables are then defined in the system as the dependent variables of the other equations in the system and thus enables us to define other endogenous variables other than the dependent variables. The reason for using 3SLS is that it not only provides consistent estimates of the parameters but is also a full information modeling technique that estimates all the parameters simultaneously and incorporates the cross-equation correlations and produces parameter estimates which are asymptotically more efficient than Two-Stage Least Square (2SLS). To calculate bank efficiency (Eff/O), I use the Malmquist Productivity Index (MPI) which uses distance functions to measure changes in productivity. I measure technical efficiencies using the non-parametric method, Data envelopment analysis (DEA) technique which has been used by (Paul & Kourouche, 2008) and (Alkhathlan and Abdul Malik, 2010a) among others.

Chapter 6 is the third empirical chapter and investigates the effects of bank efficiency and competition on the cost of credit for borrowing firms empirically. We estimate our cost of credit models using Pooled OLS, FE and RE methods. We evaluate five models incorporating each one of the efficiency measures as the leading independent variables while controlling for a set of firms, industry, and macroeconomic variables. We start our analysis by pooling the panel data and estimating it using ordinary least squares (OLS) regression. This method ignores the firms' heterogeneities and un order to correct for this bias, we use both FE and RE approaches to account for the distinct nature of each firm and control for the unobserved fixed effects that are constant over time and correlated with the dependent variables, such as Jordan's geographical location and cultural norms. These methods capture the within-variation across firms and time-related shocks that affect all firms such as global financial crises (Bjorvatn and Farzanegan, 2013). We also use RE method, wherein the main difference between RE and FE is that RE uses GLS to produce the estimates while assuming that the unobserved heterogeneity is uncorrelated with the regressors. To calculate bank efficiency (Eff/O), I use the Malmquist Productivity Index (MPI) which uses distance functions to measure changes in productivity. I measure technical efficiencies using the non-parametric method, Data envelopment analysis (DEA) technique. We use the non-parametric methods represented by the Malmquist index

proposed by (Malmquist, 1953) and later developed by (Douglas et al., 1982). This index measures total factor productivity between two banks or one bank over time. We also measure technical efficiencies using the non-parametric method, DEA. DEA technique utilizes the number of variables (inputs and outputs) and not their prices and thus does not require any relationship between inputs and outputs. Using more than one form of inputs and outputs of the Decision-Making Unit (DMU) is one of the DEA advantages (Graham et al., 2005). Defining and selecting banks' inputs and outputs for the DEA method is based on one of three approaches, production approach, intermediation approach, and value-added approach. We also use the intermediation approach in the selection of inputs and outputs which defines the bank as an intermediary that transfers assets from surplus units to deficit units (Paul and Kourouche, 2008), (Alkhathlan and Malik, 2010). In calculating the index we are using four inputs (number of full-time employees, total deposits, total assets, and interest expenses) and two outputs (loans and interest income) following (Varesi, 2015). Loans are considered one form of output from deposits (inputs) as noted by (Sealey and Lindley, 1977), (Lang and Welzel, 1996), and (Ashton and Pham, 2011).

Chapter 7 is the fourth empirical chapter which investigates the impact of banks' funding liquidity risk on Jordanian commercial banks' risk-taking behavior. For this empirical exercise, I use the FE and RE estimation methodologies to empirically define the main determinants of the different risk measures of Jordanian commercial banks. The analysis undertaken is extended to determine the major factors of the banks' liquidity funding. I also use the Difference in Difference (DID) method to analyze the impact of the deposit insurance scheme which was implemented in Jordan in 2000 as way of gauging Jordanian banks' liquidity creation. In this respect, I compared changes in liquidity creation before and after the implementation of deposit insurance. The DID approach is usually used to estimate the effect of a specific intervention (deposit insurance scheme) by comparing the changes in outcomes over time between a group that is enrolled in a program and a group that is not. The DID approach also provides results that are robust to the potential endogeneity bias as noted by (Cao, Zhun et al., 2011).

While some researchers may prefer one measure over another. There is no consensus regarding the best measure by which to gauge competition. Therefore, the choice of Panzer Ross techniques involves trade-offs. The usefulness of the different approaches hinges on data availability, the conceptions of competition assumed, and the questions being addressed. This study objective is to present the most widely applied methods in banking, highlighting their

strengths and weaknesses. This method has been used by several authors to determine the structure of banking market in some countries that have the same conditions. For example, in Tunisia, (Haffani, 2002) examined the market structure of Tunisian's banking sector during the period 1980 to 1999, by using the Panzar-Rosse assessment. This study of competition shows that throughout this period, the Jordanian banking market has been characterized by a monopolistic structure, but the indicator of competition has steadily increased since. This method has been much more widely used in empirical banking studies.

Since the data from developing country, it is appropriate to observe and duplicate (with some modifications) the methods used by (Bourk, 1989). Using multiple regression analysis, (Bourk 1989) examined the relationship between profitability and various independent variables such as interest rate, liquidity concentration, market growth, and inflation. The proxies for profitability are return on assets, return on capital and value added. The value-added concepts introduced by (Bourk 1989) is a proxy that allows testing of the expense's theory and risk-aversion theory. The used variables in the study regression and directly influence the bank profitability are used to test the expense-preference theory, the risk- aversion theory, and the structure-conduct-performance theory. For example, the capital ratio, liquidity, and other variables as an internal variable used to test the (Bourk 1989) hypothesis that well capitalized banks enjoy access to cheaper resources of fund maintained in the loan portfolio, which improve profitability as the case in the Jordanian commercial banks. In the case of liquidity, banks with higher liquidity will prevent themselves from long term investments opportunities and thus reduce their cost and expenses. Other overhead cost will have an adverse effect on profitability. The study tested hypotheses and results that are in line with and supports the existence of the expense-preference and the risk- aversion theory.

The panel data are commonly used because it gives more informative data. It consists of both cross-sectional information that captures individual variability and time series information, which captures dynamic adjustment. Moreover, it allows the studying of impact of macroeconomic and financial industry development on profitability after controlling bank-specific characteristics as in this study. The study used panel data, the panel data regression techniques have two models, Fixed effect model and Random effect model (Sarafidies & Wansbeek, 2020). Using the FE and RE is the appropriate technique for the data that has been used.

An important aspect of this model is reorganization that changes in both capital and risk

have an exogenous as well as an endogenous character. Hence, the present study differs from previous studies, it examines the most banks in the H.K. of Jordan, namely those have at least five years financial statement throughout the estimation period. It should be stressed that Jordan banking market has not reached a high level of development and hence sophisticated financial instruments are not widely available which make the used method is the more appropriate in regards to the data availability and the consider the changes in the regulation especially in term of bank capital and risk.

1.4 Research summary and conclusion

Chapter 2 presents a survey of the literature on banking sector performance indicators and discusses the main theoretical and empirical findings of previous studies and identify the main gaps in the literature that present thesis fills as applied to the Jordanian banking sector. The chapter covers separate performance indicators and lists the existing evidence of its impact performance and risk-taking behavior.

Chapter 3 discuss the evolution of the Jordanian banking sector and consider the recent reforms that have helped shaped the banking sector into a more modern banking system. The chapter highlights the reform phases while addressing the objectives of each phase and how it affected bank performance. Chapter 4 shows that the Jordanian banks results support the favourable spillovers of the reform policies on Jordanian banks' overall profitability and efficiency. However, the evidence suggests that there is still a need to improve the banking market and that higher total banks assets may not necessarily lead to higher profits. Moreover, careful management is required for the larger number of deposits and the acquired capital by Jordanian banks due to the inward migration of Iraqi and Syrian refugees to Jordan in recent times.

Chapter 5 is one of the first attempts to assess the effects of the CBJ reforms and deregulation policies on the productivity of the banking system in Jordan. The analysis provides robust evidence in favor of the positive effects of these reforms. The range of policies adopted by Jordanian banks such as the increase in their dependence on interbank funding and the capital reserve as well as their enhanced access to the deposit market, have all contributed to the improvement of profitability, cost-efficiency and overall operational efficiency. Another important factor contributing to enhancing Jordanian bank efficiency during the study period was the decline in total provisions, which reduced the banks' total

expenses. The decrease in non-performing loans (NPLs) further improved banks overall operational efficiency.

Chapter 6 assess the impact of reform program and deregulations on the Jordanian banking system and the impact of banks competition and efficiency on the cost of credit for a 118 Jordanian firm in response to the imposed capital requirements covering the period 2003-2015 as well. The results show the favorable impact of the program and liberalization on the bank efficiency which improve the household and business to accesses credit.

Chapter 7 turns to in an examination of liquidity funding and risk-taking behavior of Jordanian Commercial Banks. The findings show that bank size and capital buffers help minimize Jordanian commercial banks' risk-taking behavior in response to decreased funding liquidity risk. Jordanian commercial banks are the more conservative even during the financial crises as they are monitored and controlled by the CBJ. Findings reveal that the implementation of the deposit insurance scheme from 2000 onwards did not change the negative relationship between bank capital and liquidity creation. There appears to be a clear tradeoff between imposing bank capital requirements to maintain the financial system stability and the process of liquidity creation to enhance banks' capital assets. However, this trade-off needs to be carefully considered when decision-makers and regulators design new policies or levy new measures on Jordanian commercial banks.

The issues examined throughout this thesis are motivated by several recent studies. In chapter four, our study builds on the work of (Molyneux and Thornton, 1992) and (Bikkera and Vervliet, 2018). We extend the analysis to data on a sample of 13 Jordanian commercial banks by incorporating more variables and assessing the impact of competition, liquidity risk and interest rate on bank profitability and risk-taking behavior. The study also makes use of more factors to show its impact on Jordanian bank profitability. Chapter five builds on the contribution of (Tan and Floros 2013) by extending their study using data for 13 Jordanian commercial banks to examine the magnitude and direction of the dynamic relationships between bank efficiency/productivity, capital and risk in response to the imposed capital requirements covering the period 2003-2015. Chapter six examined the impact of banks competition and efficiency on the cost of credit for a 118 Jordanian firm in response to the imposed capital requirements covering the period 2003-2015 on the contribution of (Shamshur and Weill, 2019) and (Fungá˘cováa et al., 2017). Chapter seven builds on the contribution of (Khan et al., 2017) by investigating the relationship between funding liquidity

and bank risk-taking and extend their study by looking at the impact of imposed Jordanian deposit insurance scheme.

CHAPTER 2

Liquidity Risk, Risk-Based Capital Requirements, and Capital Adequacy Regulations: A Review of the Literature

2.1 Introduction

The Middle East and North African countries promote reform programs in order to promote a rapid and lasting economic growth and an efficient financial system. The MENA region covers Afghanistan, Algeria, Bahrain, Djibouti, Egypt, the Islamic Republic of Iran, Iraq, Jordan, Kuwait, Lebanon, Libya, Mauritania, Morocco, Oman, Pakistan, Qatar, Saudi Arabia, Somalia, Sudan, the Syrian Arab Republic, Tunisia, the United Arab Emirates, West Bank and Gaza, and Yemen. In the MENA countries, progress on financial system reforms has been uneven. Some countries now have a well-developed financial system, particularly banking sectors, such as the Gulf Cooperation Council countries (GCC, comprising Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates or U.A.E.), Lebanon, and Jordan. Others have made important advances over the past three decades. In terms of regulation and supervision, GCC countries, Jordan, Lebanon, Morocco, and Tunisia, they took strengthened banking supervision and regulation steps, such as conforming to international Basel standards by reducing non-performing loans and increasing capital adequacy ratios. Most of the MENA countries experienced financial development although in a few countries' political instability or conflict. In financial development, the research shows that the MENA region ranks well below the industrialized countries but above most other developing country regions. Egypt, Jordan, Morocco, and Tunisia are the countries in the MENA region that have been important advances in financial system development since the 1960s while in the countries, the level of financial development has improved only slightly. The MENA countries (Egypt, Jordan, Lebanon, Morocco, and Tunisia) share similarities in terms of economic structure. Despite the substantial transformation of the countries' banking and financial system in recent years. In the MENA region, the banking system has many similarities but are also quite different from each other. For example, Egypt, Jordan, Morocco, and Tunisia are classified as lower-middle-income countries, while Lebanon classified as a middle-income country. The financial development has been shown to have a main role in enhancing the economic growth (Beck et al, 2006); however, empirical evidence indicates that without the necessary institutional

development, financial systems may lead to increased risk (Demirguc-Kunt and Detragiache, 2006). Cross country differences are apparent for example, Jordan outperforming the other countries in the MENA region in terms of stock market development and the capital adequacy ratio.

In 1988 the agreement referred to as the Bank established the Basel Accord for International Settlement (BIS) for measuring bank capital adequacy for banks in the Group of Ten (G-Ten) countries and Luxembourg. This Accord established a framework consisting of several core rules designed to regulate bank capital and to minimize credit risk, referred to as Basel I which classified bank assets into five risk categories in percentages (0%, 10%, 20%, 50%, and 100%) depending on the nature of the debtor. Cash, central bank and government debt are classified as 0% risk assets. The 50% category which includes residential mortgages and private sector debt is classified as 100% risk asset. This framework mandated the minimum required capital, Tier 1 and Tier 2 equal to at least 8 percent of a bank's capital adequacy requirements which became standard for banks internationally. Since the BCBS do not have legal influence, members are free to choose whether to implement the established standards and the methods of applications. A major criticism of Base I concerned the arbitrary nature in which it was applied especially the 8 percent minimum capital requirement applied to risk-weighted assets remained irrespective of (a) whether the degree of credit-risk varied over the business cycle (b) whether the bank was domiciled in an industrialised or developing country and (c) the types of risk banks engaged with. As a result of the limitations of Basel I, the framework was amended in 1996 and went into effect in 1998 and required all commercial banks engaged in significant trading activity to set aside additional capital under the 8 percent mandate to cover the market risks in their trading accounts. In addition, a new Tier III capital was brought in consisting of short-term subordinated debt which could be used to accommodate the capital requirements on market risk. Considering other emerging limitations, such as operational risk, which include fraud, computer failure and poor documentation which many observers considered as significant risk. In 1999 the Basel Committee proposed a new capital adequacy framework referred to as Basel II. Basel II which is based on three mutually reinforcing pillars – minimum capital requirements, a supervisory review process and the effective use of market discipline was supported by central bank governors and bank supervisors in the G-10 countries and came into effect in June 2005. Basel II adopted the minimum capital requirements of 8 percent, but also distinguished the required minimum capital ratio based on three tiers. The higher the tier, the fewer securities banks can include in

it. Another important part of the Basel II framework is improving the calculation formula for Risk-Weighted Assets (RWA), which imposed a penalty for the excessive risk-taking behaviour by banks whenever the banks significantly increased risk-weighted assets intentionally. Risk-weighted assets are used as a denominator in the calculation of the regulatory capital ratio and is calculated by using the sum of assets that are multiplied by the corresponding risk weight for each type of asset. Steering these measures was meant to create uniform conditions for better risk measurement and regulating international competition on financial markets.

Following the adverse effects of the 2008 global financial crisis exposed deficiencies in the Basel I and II framework. Many banks encountered difficulties to maintain adequate liquidity, primarily due to the lack of traditional funding sources, due to the valuation of assets and due to capital adequacy issues, which resulted in large financial losses. As a result, in 2010 the G-10 central banks and supervisory authorities established a set of new regulations, named Basel III in the form of a substantial strengthening of the existing regulatory capital framework and which requires increased minimum Common Equity Tier 1 capital from 4 percent to 4.5 percent and minimum Tier 1 capital from 4 percent to 6 percent in an effort to mitigate the adverse effects of the financial crises as well as to prevent future potential crisis and bank bailouts. The thinking behind Basel III was to ensure a build-up of bank capital buffers that can be drawn down during periods of financial stress, strengthen the quality of bank capital, and introduce a leverage ratio requirement that would control the excess of leverage.

Following the Basel III regulations, the banks become entitled to increase their core capital ratio from 4 to 6 percent to ensure the overall financial system's efficiency and stability and lower the risk of default. Basel III adopted the same guidelines of Basel II in calculating risk-weighted assets and introduced leverage and liquidity requirements to ensure that banks have sufficient liquidity to hedge against excessive borrowings and in comparison, to Basel II, Basel III adopted stricter regulatory capital ratios.

The introduction of the various Basel capital accords has motivated a stream of studies that have examined the effects of bank capital regulations on banks' risk-taking behavior and management. The main findings of most of these studies indicate that bank financing decisions are influenced by several factors, such as capital adequacy regulations, risk-based capital and liquidity risk management. As with other central banks, the central bank of Jordan (CBJ) attempted to enhance the integrity and stability of the financial sector in Jordan through the

application of the Basel international standards, particularly the standards of the Basel I and II and Basel III post the global financial crisis. In 2005, a higher committee chaired by the deputy governor of the CBJ was formed to discuss the adoption of new standards of credit risk, market risk, operational risk, market discipline and the supervisory review. The CBJ began implementing the Basel II standards in the first quarter of 2008. The first phase incorporated Basel II capital adequacy ratios' adoption and utilised different measures to assess operational and market risks. In 2011, the CBJ informed the banks to start implementing the requirements of Basel III by increasing the proportion of liquidity coverage, legal liquidity ratio, and capital adequacy ratio.

Several empirical studies investigate the determinants of bank profitability such as (Short, 1979); (Bourke, 1989); (Molyneux and Thornton, 1992); (Abreu and Mendes, 2001); (Mamatzakis and Remoundos, 2003); (Goddard et al., 2004); (Pasiouras and Kosmidou, 2007); (Bennaceur, 2008); (Albertazzi and Gambacorta, 2009); (Lee and Hsieh, 2013); (Sufian and Habibullah, 2009); (Naceur and Omran, 2011). The drivers of bank profitability are categorized into internal and external factors. The internal factors are related to a bank's management and strategies while the external factors are related to the economic and legal environments inside the country. Factors such as loan loss expenses, loan/deposit ratio, capital, liquidity ratios, market dynamics, interest rates, concentration and overhead expenditures are investigated in the literature considering their effect on profitability. The findings covering these factors are found to be sensitive to the sample selection, bank size, level of capital and the adopted risk management practices. Studies such as (Abreu and Mendes, 2001) found a positive impact of risk on bank profitability in France, Spain, Portugal and Germany. (Ahmed and Khababa, 1999) examined the impact of business risk, market size and the size of the Saudi banks' profit and found that business risk and bank size are the only significant drivers of profitability, while business risk and bank size had a significant and negative influence on banks' profitability.

Since the introduction of the 1988 Basel Capital Accord, Capital adequacy requirements became one of the most important measures of bank asset-liability management. Bank regulators are required to assess whether banks are adequately capitalized to ensure the stability of the banking system against temporal shocks. Several empirical studies have focused on investigating the impact of the introduction of the Basel Capital Accord in 1988 on capital adequacy requirements across different countries. Empirical evidence suggests that capital adequacy requirements amplify demand and supply-side shocks in the US (Blum, 1999), reduce the risk-taking behavior of US commercial banks (Konishi and Yasuda, 2004) and force

less-capitalized banks to increase their capital levels (Zhang et al., 2008).

Another strand of the literature discusses the theoretical and empirical effects of risk-based capital regulations on financial systems. However, in terms of bank performance, capital ratio is considered a better performance indicator than the risk-based capital ratio (Avery and Berger, 1991). Some studies have shown that risk-based capital requirements have minor effects on loan growth (Allen et al., 1994). On the other hand, it has been argued by (Brinkmann and Horvitz et al., 1995) that risk-based capital requirements have influenced banks' portfolio decisions and loan growth significantly.

Many banks have reduced their credit supply to meet capital regulations when they were first introduced in the late 1980s, but after the global financial crises, capital regulation requirements became a major concern for bank managers and regulators. As suggested by (Yehuda Kahane, 1977) capital regulations cannot reduce the overall bank portfolio risk unless the assets included in the portfolio are subject to these regulations but has noted by (Keely and Furlong, 1990), capital regulation can potentially reduce asset risk, while (Santos, 1999) showed that capital regulation improves bank's stability. Regarding the risk (Hussain and Hassan, 2005) suggest that banks' portfolio risk dropped following the adoption of capital requirement regulations while (Delis et al., 2011), and (Beatty and Gron, 2001), suggest that capital regulations reduce risk in general but for banks with high market power the risk mitigation effects become weaker though in some cases, they can be reversed.

It is widely recognized that financial institutions require effective management to hedge against different types of operational risks. Several studies on developing and developed countries have examined different risk measures and the related practices that were adopted by different banks to mitigate potential losses. In classical theories, there is a close relationship between liquidity risk and credit risk (Bryant, 1980). Previous studies by (Goldstein and Pauzner, 2005), (Goderis et al., 2011), (Gatev et al., 2009), (Cai and Thakor, 2011), and (Acharya and Viswanathan, 2011) have shown that the inter-correlations between liquidity and credit risk affect bank stability. However, since the 2008 financial crises, the literature in this area has produced mixed results. For example, (Archarya and Viswanathan, 2011) find evidence which suggests a positive relationship between liquidity and credit risks while (Goderis et al., 2011), (Gatev et al., 2009), (Cai and Thakor, 2011), and (Acharya and Viswanathan, 2011) report evidence suggesting that the relationship between liquidity and credit risk is negative. In a study of advanced economies, (Chen et al., 2018) found that liquidity

risk reduced profitability due to the higher cost of fund but increases banks' net interest margins while (Young and Jang, 2016) found that the implementation of the Basel III net stable funding ratio standards had significant positive effects on U.S bank liquidity management.

Given the various themes of this thesis, the purpose of the present chapter is to provide a review of a selection of the most important literature covering the work presented in the empirical chapters of the thesis. The chapter is divided into six subsections wherein section 2.2 focuses on studies on banks' profitability indicators. Section 2.3 discusses capital and capital adequacy requirements while section 2.4 discusses the literature on the risk-based capital, section 2.5 capital regulation and its impact on banks' performance and section 2.6 the related literature on bank's liquidity, liquidity and credit risk. Section 2.7 concludes the chapter.

2.2 Bank profitability indicators literature review

Banks, like all businesses, operate to maximize profit or shareholder wealth by earning more money than what they pay in expenses. Some of this also comes in the form of fees that banks charge for services provided and the interest on assets. Normally interest paid on bank liabilities is the major expense of banks. Loans to individuals, businesses and other organizations and the securities that it holds are the major assets of banks, while deposits and the money it borrows forms its liabilities. Over the years, bank profitability has been a popular research topic with most studies investigating the determinants of bank profitability. These include (Moylneux and Thornton, 1992), (Demerguç-Kunt and Huizingha, 1999), (Barajas et al. 1999), (Bashir,2000), (Ben Naceur and Goaied, 2001), (Abreu and Mendes, 2002), (Guru et al., 2002), (Jiang et al., 2003) and (Pasiouras and Kosmidou, 2007).

(Pasiouras and Kosmidou, 2007) found evidence of a positive and significant relationship between bank size and profitability, while (Abreu and Mendes, 2001), using a loans-to-assets ratio as a proxy for risk, found a positive impact of risk on bank profitability for banks in France, Spain, Portugal and Germany. On the other hand, a negative and significant relationship was found between the level of risk and bank profitability by (Bourke, 1989) and (Molyneux and Thornton, 1992). (Bourke, 1989), (Demirgüç-Kunt andHuizinga, 1999), (Abreu, and Mendes, 2001), (Goddard et al., 2004); (Pasiouras and Kosmidou, 2007), and (Bennaceur, 2008) found that banks with a high level of equity relative to their assets have higher profitability than their counterparts and (Goddard et al., 2004) report that the cost-income ratio affects bank profitability positively. Other studies such as (Bourke, 1989), (Molyneux and Thornton, 1992), (Demirgüç-Kunt and Huizinga, 1999), (Athanasoglou et al.,

2008), (Albertazzi and Gambacorta, 2009) indicate a positive relationship between inflation, GDP growth and bank profitability. According to (Bourke, 1989) and (Molyneux and Thornton, 1992), high bank concentration ratio (CR) enhances profitability, though (Demirgüç-Kunt and Huizinga, 1999) and ((Staikouras and Wood, 2011) have argued that concentration ratio reduces profitability.

Bank liquidity, capital adequacy, deposit growth, credit risk, GDP, and inflation are considered the main determinants of bank performance (Azam and Siddiqui, 2012). (Flamini et al., 2009) suggests that credit risk, market power, capital, size, GDP and inflation are the most important profitability triggers. At the same time (Ahmed and Khababa, 1999) considers business risk, market size, market concentration and bank size as the main determinants of bank profitability. (Short, 1979) and (Bourke, 1989) examined the determinants of bank profitability using a linear functional form and found that linear modeling yields better results relative to other functional forms. (Short, 1979) found that greater market power leads to higher profitability, while concentration ratio was not significant in influencing profitability. (Smirlock, 1985) investigated the relationships between bank profitability, market share (MS), and market concentration using annual data consisting of 2700 banks over the period 1973-1978. Using different profits proxies, ROE, return on total capital and return on total assets and a wide set of control variables such as growth in market deposits, a ratio of demand deposits to total deposit, total bank assets, the effect of holding company affiliation and state law with respect to multibank holding companies, he estimated cross-sectional profit. The findings indicate that concentration is insignificant in explaining bank profit rates. The results also showed that market share is positively and significantly related to profitability. Additionally, the control variables: growth in assets, market deposits, and the ratio of demand deposits to total deposit were found to have a positive relationship with profitability while holding a company affiliation and state law had negative coefficients. Using annual financial data for 90 banks across twelve countries/regions (Belgium, New York, Denmark, Australia, Ireland, Massachusetts, California, Canada, England and Wales, Holland, Norway and Spain.) for the period 1972-1982, (Bourke, 1989) investigate the determinants of bank profitability. Using capital ratio, liquidity, staff expenses, concentration, government ownership, interest rate, market growth and inflation as independent variables and return on capital, return on assets, value-added return on total assets as dependent variables. The results showed that all capital ratios, liquidity ratios and interest rates are positively related to profitability. Government ownership and staff expenses were found to have an inverse relationship with pre-tax return on

assets. Concentration is moderately and positively related to pre-tax return on assets and negatively with the value-added. (Molyneux and Thornton, 1992) replicated (Bourke, 1989) study using annual data for a sample of banks covering 18 European countries for the period 1986-1989. They used government ownership, concentration, long-term bond rate, money supply, capital and reserves, cash and bank deposits, consumer price index, and staff expenses as independent variables and net profit before and after taxes as dependent variables. The findings indicate that staff expenses have a positive relationship with ROA and that government ownership and the level of interest rates have a significant positive associations with ROE, which contrast with the findings of (Bourke, 1989). Liquidity was found to have a weak and inverse relationship with profitability due to the costs of liquidity holdings. And in line with (Bourke, 1989), concentration was found to have a positive and statistically significant impact on pre-tax return on assets.

Using ROA and ROE as proxies for bank profitability, (Berger, 1995) examined the impact of concentration, market share, x-efficiency, scale efficiency, and other control variables on profitability. The findings revealed that X-efficiency and market share have a positive impact on bank profitability and that the concentration-profit relationship is ambiguous as its influence was primarily due to the level of correlation with other variables, particularly market share. (Ahmed and Khababa, 1999) using ROE, ROA, and PEPS as profit measures, examined the impact of business risk, market size, and bank size on bank profitability for a sample of eleven commercial banks in Saudi Arabia for the period 1987-1992. They found that business risk and bank size are the only significant drivers of profitability, while business risk and bank size had a significant but negative influence on banks' profitability. (Demirgüç-Kunt and Huizinga, 1999) contributed to the existing literature on bank profitability by investigating the determinants of the commercial bank profitability using annual data of 80 banks from developed and developing countries and applied the weighted least squares method. Their findings indicate that well-capitalized banks had lower funding costs than less capitalized banks due to the low probability of the cost of bankruptcy and that well-capitalized banks had lower needs for external funding relative to less capitalized banks. The results also find the presence of a positive relationship between capital ratio and profitability but found no evidence of a relationship between profitability and overhead expenses as banks usually transfer these costs to their customers invoices. The reported findings also show that loans to total assets negatively influenced bank profitability, whilst short-term funding had a negative but significant impact on profitability. A negative

relationship between profitability and non-interest earning assets was also reported, since banks with high non-interest earning assets were found to be less profitable while banks that consider deposits as their main source of funding were found to be less profitable due primarily to the nature of deposits which required high branching costs and other related expenses. Interestingly, in the case of developing countries, the findings suggest that foreign banks produced greater profitability than domestic banks, with a high level of concentration accounting for the enhanced profitability owing to the lack of competition. This particular result contradicts (Abreu and Gulamhussen, 2015) findings, who reported a negative relationship between the level of concentration and bank profitability.

In their contribution to the literature, (Guru et al., 1999) examined the determinants of high-profitable banks in Malaysia using quarterly data for a sample of seventeen banks during the period 1986 to 1995. They used liquidity, capital adequacy, expenses management, assets composition, firm size, inflation, market growth, market interest, market share and regulation as explanatory variables and used net income before and after-tax as a percentage of total assets, net income before and after-tax as a percentage of shareholders capital, and reserves are used as proxies for bank profitability. They found that poor management was the main reason for a low-profit share, while liquidity, high capitalization, and asset composition reduced profitability. The size variable was found to have no impact on the profitability of Malaysian banks, while market growth was reported to have a negative relationship with bank profitability which contradicts the findings reported by (Bourke, 1989).

(Chirwa, 2003) also investigate the relationship between market structure and profitability of commercial banks in Malawi using annual time series data for eight commercial Banks during 1970-1994. The study employed as explanatory variables the ratio of capital to assets, total deposits of the banking industry, growth rate of total deposits, the ratio of demand deposits to total deposits, loans to assets, concentration, and bank size, while ROA, ROE, and ROC were used as measures of profitability. Based on the work of (Gilbert, 1984), (Smirlock, 1985), (Clark, 1986), and (Maudos, 1998). (Chirwa, 2003) report that demand deposit to deposits ratio and concentration had positive and significant effects on commercial bank profitability, and that loan to assets ratio had a positive and significant impact on bank's profitability in both the short and long-run. (Goddard et al., 2004) add to the literature by examining the profitability drivers for European banks for a selection of six countries during the period 1992 to 1998 using both static and dynamic GMM models. The findings of (Goddard et al., 2004) showed that off-balance-sheet activities and profitability are positively

correlated, but only for English banks while more generally, the profitability was found to be influenced by liquidity and capital to assets ratio. (Al-tamimi, 2008) compared the determinants of bank performance between the national and foreign banks in the United Arab Emirates (UAE) during the period 1987 to 2002. The findings indicate that bank size and portfolio composition are the significant determinants of national banks' profitability, while for foreign banks, capitalization, leverage economic condition, and capital productivity are the main drivers of profitability. The findings also suggest that concentration, portfolio composition and costs are more relevant to the profit shares of national banks than foreign banks. In another related study, (Bennaceur, 2008) looked at the impact of bank-specific characteristics, covering financial structure and macroeconomic indicators in the Tunisian banking industry from 1980 to 2000 and used NIM and ROA bank profit measures. The ratio of equity capital to total assets, overhead to total assets, the ratio of bank's loans to total assets, the ratio of noninterest-bearing assets to total assets, bank concentration, GDP, inflation and bank size were used as independent variables. The study applied both Fixed Effects (FE) and Random Effects (RE) methods. The reported results indicate positive relationships between the two profitability measures and the amount of capital and that a well-capitalized bank can raise capital with low costs. ROA was reported to be significantly and cyclically correlated with large overheads and bank loans, while noninterest-bearing assets had no significant impact on both NIM and return on assets, proving that interest-bearing assets are the main sources of bank profit. Interestingly, bank size showed a negative and significant impact on profitability which contradicts the findings of (DeYoung and Rice, 2006), while stock market capitalization was found to enhance bank profitability. However, the level of concentration had a negative and significant impact on net interest margin.

In another strand of the literature, (Athanasoglou et al., 2008) examined a wide scope of bank-specific, industry-related and macroeconomic profitability determinants using panel data for a group of South-Eastern European (SEE) credit institutions. Using a fixed effect and a random effect method. The results indicate that bank size had a positive and significant impact on bank profitability contrary to (Goddard et al., 2004), and also showed that all bank-specific determinants significantly affect bank profitability, except the liquidity variable. Bank concentration and capital were reported to be significant drivers of profitability, which is consistent with the findings of (Goddard et al., 2004), while Loan-loss provisions and operating expenses are significant moderators of profitability. Bank loans were found to have no significant bearing on the profitability of SEE credit institutions. Regarding the

macroeconomic indicators, inflation was the only found to be a significant driver of bank profitability.

(Flamini, et.al., 2009) studied the determinants of bank profitability using a sample of 389 banks for a sample of 41 Sub-Saharan Africa countries (SSA) for the period 1998 to 2006 using the c two-step GMM approach. They found that all foreign banks in SSA channeled their activities into the service sector to avoid financing riskier sectors such as agricultural. Bank size, diversification, capital and private ownership were found to be the main drivers of bank profitability which support the reported findings of (Athanasoglou et al., 2008). (Dietrich and Wanzenried, 2011), using a sample of 453 Swiss commercial banks for the period 1999-2006, looked at bank profitability by employing internal and external determinants of bank profitability (with ROA and ROE being proxies of profitability). They found that profit is significantly driven by capitalization, bank loans and GDP growth while those banks with a higher share of interest income were found to be less profitable than their counterparts.

(Al-Jarrah, 2010) examined the competitiveness and contestability in the Jordanian's banking industry for the period 2001-2005 using (Panzar and Rosse, 1987) "H statistic". He found that the Jordanian's banking market cannot be characterized by either perfect competition or monopoly and the banks found to earn their revenues as if operating under conditions of monopolistic competition in that period. The analysis of changes in competitive structure shows a lower degree of competition in the later years of the sample period and the large banks operating in a relatively more competitive environment compared to small . These developments trigger the need for further structural deregulations and liberalization to the banking system of Jordan, to reduce the market concentration and enhance the competitiveness of this market.

(Heffernan and Fu, 2011) examined the profitability of 96 Chinese banks for the period 1999-2006 using EVA, return on average assets (ROAA), return on average equity (ROAE) and NIM as proxies of bank profitability and estimated the GMM motivated method. The findings suggest that EVA and NIM are better performance indicators than the remaining variables while specialization and bank profitability are positively correlated. The findings also indicate that banks that finance rural development were more profitable than their counterparts, and that bank listings, ownership, and size had no significant impact on the profitability of Chinese banks. However, loan loss reserve ratio was found to enhance all profitability measures, except for the variable ROAE.

Following the approach of (Brooks, 2008), (Anbar and Alper, 2011) examined bank-specific and macroeconomic determinants of bank profitability in Turkey for the period 2002-2010 using FE approach. Their findings indicate a positive and significant relationships between bank size, asset size in relation to the profitability measures ROA and ROE and NIM, which highlights the profit impact of economies of scale. A negative and significant influence of assets quality and loans on ROA was also found. More recently, (Hussainey et al., 2018) looked at the impact of efficiency on the performance of 151 Islamic banks with a global presence for the period between January 2013 and December 2013 by estimating OLS model. They found bank cost-to-income ratio (CIN) to be negatively associated with the performance of Islamic banks globally and a positive association between risk-based capital adequacy, the existence of Sharia auditing department and the performance of Islamic banks, but the evidence on the impact of bank size on profitability was inconclusive.

(Guglielmo,etal, 2017) examined the internal and external factors impact on the banking sector in the Middle East and North Africa region, on the profitability. They found that the size does not appear to play a role determinant of profitability, whilst the liquidity ratio and net interest revenues seem to have a negative and positive effect respectively; GDP has a positive effect.

Using uses the generalized method of moments (GMM), Least Squares (LS) and Generalized Linear Model (GLM), (Huq, et al, 2020) examined the impact of competition and cost efficiency on the profitability of banks using an unbalanced panel of emerging economic MENA countries over the period between 2011 and 2017. They found a significant and negative impact of competition on profitability of banks. They suggested that MENA banks should more improve the process of managing and monitoring the loan segment business; reducing the level of credit risk leads to higher profitability.

2.3 Capital and capital adequacy requirements literature review

It is well established that capital adequacy plays a significant role in maintaining the safety and soundness of banking systems globally. This is because, capital adequacy and capital adequacy regulation ensures that banks are adequately capitalized and thus equipped to withstand unexpected shocks that might otherwise impact negatively on bank operation such that it affects bank depositors. The term capital adequacy reflects the capacity and efficiency of banks to measure, control and monitor every type of risk. The importance of capital adequacy for the

Jordanian banking system is not limited to simply providing sufficient capital coverage to hedge against potential risks but is also directed towards developing proper strategies in the maintenance of sufficient levels of capital that is higher than the imposed fixed regulatory capital ratio.

Understanding how capital requirements are operating and what effects they have on risk and efficiency measures of the banking sector is essential for maintaining the balance between liquidity reserves as a form of protection and profitability. Thus, steering the capital adequacy requirement may be considered one of the most important policy measures of Basel II, if only because it helped to protect the global banking system from the adverse effects of potential stresses and the risk of default. In turn, it has given rise to a growing literature covering issues ranging from best practice, stress testing, scenario analysis relating to bank's portfolio, among other related issues. For example, (Bernanke et al, 1999) used cross-sectional data of state-by-state US banks for the period 1990-1991 and report that banks' capital-to-asset ratio had a positive impact on loan growth, while (Cecchetti and Li, 2008) and (Blum, 1999) found that capital adequacy requirements may amplify demand and supply-side shocks. (Choi, 2000) in a study of Korean banks found that the imposition of the 8 percent capital adequacy requirement on banks led to a decline in bank lending, while (Konishi and Yasuda, 2004) argue that applying capital adequacy requirements reduced the risk-taking behavior of commercial banks. In their study of Spanish banks, (Barrios and Blanco, 2003) analyzed how banks set their capital ratios (the rate of equity capital over assets). (Barrios and Blanco, 2003) report that the imposed regulatory constraints were not significant in explaining the effectiveness of Spanish commercial banks but that the biggest impact had more to do with the pressure of market forces. (Toby, 2008) investigated the effects of capital adequacy regulation on Nigerian bank asset quality for the period 2002-2004. The capital adequacy ratios are captured by equity to-total assets, equity-to-loans and advances, and permanent assets-to-equity. The reported findings indicate that equity-to-total assets ratio is insignificant in determining the level of classified loans in the total loans' portfolio, while an increase in the equity-to-loans and advances ratio are found to significantly reduce the ratio of classified loans as a percentage of equity stock. It is also noted that a high ETA can minimize the ratio of operating expenses to total revenue because of economies of scale and scope and that the ratios of equity to loans and advances have a significant inverse association with CLR.

In their study of 12 Chinese commercial banks for the period 2004-2006, (Zhang et al., 2008) examined the impact of capital adequacy requirement on bank's risk-taking behavior by

applying the GMM method. (Zhang et al., 2008) found that the compulsory enforcement of capital adequacy requirements forced less-capitalized banks to increase their capital levels and that higher capital level reduced the overall risk-taking behavior of banks, particular the portfolio risk of banks.

In response to the 2008 global financial crises, (Kudinska and Konovalova, 2012) examined the main determinants of bank capital adequacy for Latvian banks using a stepwise method to estimate a regression model incorporating bank capital adequacy ratio as the main independent variable (cap-adeq) and report credit risk to be the most important driver of bank capital adequacy. The findings suggest that during the financial crises, Latvian commercial banks were operating on the verge of capital adequacy as a result of substantial losses during the period of the crises which resulted in the use of inflows of new shares and subordinated capital. Provisions for outstanding debts and banks' assets were also found to be key factors influencing the capital of Latvian commercial banks. (Bridges et al., 2014) examined the effect of changes in micro-prudential regulatory capital requirements on bank capital ratios and bank lending for 53 UK banks using (FE). (Bridges et al., 2014) found that changes in capital requirements had a significant effect on the observed capital ratio which is consistent with the findings of (Alfon et al., 2005) and (Francis and Osborne, 2010) and also note that in response to an increase in capital requirements, the banks examined raised their capital ratios above the minimum requirement while also reducing their lending. (Lee et al., 2015), following a disequilibrium equation modeling approach which is considers the diversity of ownership structures of Chinese banks and examined the impact of the capital regulatory regime on the effectiveness of Chinese bank capital levels on 15 listed and 62 unlisted banks considering new regulations enforced by bank regulators in 2004 following China's membership of the World Trade Organization (WTO) in 2001 for the period 2004- 2011. The found that the Chinese regulatory regime induced banks to increase their capital level and that CBRC regulations affected unlisted banks, joint-equity banks and foreign bank's capital levels strongly. The findings also show that the new regulations influenced bank capital movements more so than recent market pressures. On the issue of the banks' ownership, the findings indicate that regulations had the expected risk control effects in localized and less centralized rural and urban commercial banks. (Daniel, 2015) examined the relationship between liquidity, capital adequacy, bank size and GDP growth rate for a sample of Kenyan commercial banks. The findings suggest that capital adequacy, bank size and GDP growth rate had a significant effect

on the liquidity of Kenyan commercial banks. (Klepczarek, 2015) using data for 49 European banks, looked at the impact of both financial and economic indicators on the level of bank capital following the 2008 global financial crisis, in particular, the factors affecting common equity Tier1 ratio (CET1) which is a measure of the relationship between core capital and the risk-weighted assets of banks. The reported findings suggest that the increase in the ratio of risk weights of assets (RWA) reduced banks' capital buffer and that competitive pressure is positively correlated with capital adequacy while the profitability indicators and the average inflation rate on capital adequacy was found to have no effect.

2.4 Risk-based capital literature review

To enhance the risk coverage of the capital framework, new rules of solvency margins were imposed by bank regulators. These rules placed higher capital weights on bank assets and during the early phase of transition in the implementation of the new rules many banks struggled to adapt to the new capital framework. This was most certainly the case with Jordanian banks as some bank assets proved inadequate for banks to maintain a diversified portfolio of liquid and profitable assets. Therefore, understanding the wealth effects of these standards is critical in any attempt to allocate capital across various activities of banks' operations and activities. Early studies along this direction, such as (Gjerde and Semmen, 1995) examined the effectiveness of risk-based capital adequacy standards when bank's deposits are fully insured by using the level of bank leverage as a measure of the effectiveness of different bank regulation mechanisms and a state-preference model that incorporate the requirements of the risk-based capital plan. Gjerde and Semmen, 1995, found the risk-based capital plan to be an effective regulatory mechanism and, moreover, that a combination of risk-based equity ratio and leverage restriction appear to be the best approach to manage portfolio risk's, which is consistent with the findings of (Mayer, 1992). Similarly, (Cai and Thakor, 2011) showed that risk-based capital requirements reduced bank lending, while (Jacques and Nigro, 1997a) report that the new regulations reduced the portfolio risks of US banks, and (Blum, 1999) report that capital requirements are associated with higher risks but only if the costs of raising new capital are excessively high. Moreover, (Acosta et al., 2018) found that leverage ratio and risk-based capital requirements are beneficial for bank stability. (Eyssell and Arshadi, 1990), using data for a sample of 27 banks examined the wealth effects of risk-based capital requirement by employing seemingly unrelated regression (SUR)

approach. (Eyssell and Arshadi, 1990) found that at the time of the announcement of the new risk-based capital requirements, the equity values of large publicly traded banks decreased and the banks with deficient capital ratios suffered the greatest loss in value.

(Cooper et al. 1991) added to the debate by investigating the effects of risk-based capital requirements adoption for a number of international banks in the US, UK, Canada, and Japan for the period 1985-1989. For securities prices, a market model approach was used to derive abnormal returns changes in the periods surrounding the announcements. They used the OLS and the variance of two-index model. (Cooper et al. 1991) report mixed results for the impact of the new regulations on equity returns in Japanese banks due to the uncertainty among investors regarding the new risk-adjusted capital rules. On the other hand, and in response to the announcements, the findings indicate a significant decline in equity returns for US, Canadian, and UK banks. In an influential paper, (Shrieves and Dahl, 1992) investigate the relationship between risk and capital using data for US commercial banks for the period 1983-1987 by utilizing a simultaneous equation approach. They found that risk exposure and capital levels are simultaneously related and that the majority of US banks raised their asset risk posture to mitigate the effects of increases in capital level.

(Ediz et al., 1998) examined the impact of risk-based capital requirements on UK bank behavior by using quarterly data over the period 1989-1995. They formulated a dynamic, multivariate panel regression model in which changes in capital ratios depend on the lagged level of the ratio, in addition to a range of control variables such as net interest income over total risk-weighted assets, fee income over total risk-weighted assets, bank deposits over total deposits, total off-balance-sheet exposures over total risk-weighted assets, and provisions over total risk-weighted assets. The regression results concluded that UK banks responded to risk-based capital requirements by adjusting their portfolio risk, while capital ratios have not changed. (Shrieves and Dahl, 1992) also found that banks met capital requirements by raising new capital rather than alternating the loan composition in assets portfolio. Their finding also suggests that capital regulations were effective in reinforcing banks' stability without disrupting banks' lending choices. Using a simultaneous equation modeling approach by (Shrieves and Dahl, 1992), (Rime, 2001) examined the impact of regulatory capital requirements on Swiss banks' risk-taking behavior by using the ratio of capital to total assets and the ratio of capital to risk-weighted assets (RCWA) as dependent variables. (Rime, 2001) found that regulatory pressure had a significant and positive impact on the ratio of the bank capital to total assets but no significant impact on bank risk-taking while a positive and

significant relationship is observed between risk and ratio of capital to total assets. Size is found to increase risk and reduce capital while regulatory pressure and PCAU have significant positive effects on the ratio of capital to RWA and no significant impact on banks' risk. (Calem and Rob, 1999) examined the required value of economic capital that is necessary to cover credit risk. They found that required capital cover varies substantially with portfolio risk, bank geography, assets' diversification and loan characteristics and that the regulatory capital standards were generally much too high for banks with regionally diversified portfolios and that adopting regulatory capital requirements would most likely reduce the incentive for such institutions to engage in regulatory capital arbitrage. (Hussain and Hassan, 2005) using data of banks in developing countries examined the impact of capital requirements on credit risk-taking. They employed both 3SLS and GMM methods and found that these regulations did not raise the banks' capital ratio and that bank size reduced capital while also increasing bank risk taking behavior.

(Francis and Osborne, 2010) examined the efficacy of regulatory capital requirements for a sample of UK banks' during the period 1998-2006 using FE and GMM methods. They found that these requirements direct banks' capital management practices to maintain targeted buffers above regulatory thresholds. (Hogan, 2015) examined both the capital and risk-based capital ratio of US banks holding companies for the period 1999-2010 to predict banks' equity risk and risk of solvency. He measured bank's equity risk by the standard deviation of their stock returns and the risk of solvency by bank's Z-scores. He report that risk-based capital ratio was not a better predictor of bank risk than the standard capital ratio and that the capital ratio is consistently and significantly much better than the risk-based capital ratio as a predictor of both stock return volatility and banks' Z-scores which are in line with the findings of (Dowd et al., 2011) who found that risk-based capital regulations based on the Basel accords suffered from the lack of information which meant that risk-based capital ratio is a poor performance indicator.

(Lemonakis. et al, 2015) measured the efficiency of the banking industry in the Middle East and North Africa (MENA) region during the period: 2003–2012. Using external and internal to the firm factors and panel data econometric modelling. They attempt to present new evidence on the relationship between efficiency, capital and risk of MENA region's banking industry. They found that bank capitalization is positively related to efficiency and profitability and negatively to size, amount and quality of loans and risk measured with Altman's Z-score and negative relationship between efficiency and risk.

2.5 Capital regulations literature review

The maintenance of a robust infrastructure and legislative structure is generally considered to be the main factors for achieving a stable financial system. In line with this objective, the Central Bank of Jordan has sought to develop the financial system's infrastructure and the relevant financial regulations in order to improve the legislative scheme of the financial system in order to secure the stability of the Jordanian financial system, especially given the experiences of OECD countries which showed that inadequate supervisory and regulatory rules can contribute significantly to initiating and intensifying crises faced by banks. In this regard, it is important to investigate how capital regulations have affect the stability and safety of Jordanian banks' since very little or no evidence of this exists in the current literature.

One of the earliest studies examining the effectiveness of infrastructure and legislative structure is detailed in the work of (Kahane, 1977) who looked at the effectiveness of regulatory instruments in protecting intermediary's solvency and found that capital regulation was unable to reduce overall bank portfolio risk unless the asset composition of the bank's portfolio is subject to these regulations and that constraining the portfolio composition of the intermediary cannot generally be regarded as an effective means for bounding the firm's probability of bankruptcy. (Keeley and Furlong, 1990), using a mean-variance approach examined the effects of bank capital regulation on the asset and bankruptcy risk of insured, utility-maximizing banks. They found that the shift in the risk-return frontier is triggered manly by capital regulations. (Mayer, 1992) studied the consequences of capital regulations on the portfolio choices of commercial banks. He concluded that risk-based deposit insurance premiums are stronger moderators for portfolio risk than capital requirements. In contrast to a setting of incomplete markets, limited liability and shareholder-utility-maximizing banks, he found that capital regulation can potentially reduce asset risk which is consistent with the findings of (Keeley and Furlong, 1990). (Mayer, 1992) point out that there are three possible scenarios when capital requirements are unexpectedly introduced by complete-market, deposit-insured and value-maximizing banks. The first one is that no increase in capital is observed and the bank invests in a combination of one risky asset and one riskless asset, the second scenario is when no increase in capital is observed and the bank invests in a combination of two risky assets and the third scenario occurs when the bank invests only in one single risky asset to meet the imposed requirements.

(Cai and Thakor, 2011) analyzed the effects of capital regulation on bank behavior

using data of US banks for the period 1986-1993. (Cai and Thakor, 2011) report that increases in risk-based capital requirements and regulatory subsidies stochastically reduced aggregate bank lending especially for those banks with higher capital costs. In addition, (Barrios and Blanco, 2003) using a disequilibrium estimation approach examined how 76 Spanish commercial banks (over the period 1985-1991) set their rate of equity capital over assets (capital ratios) to avoid bankruptcies. They report that regulatory constraints are not significant moderators of capital augmentations in Spanish commercial banks and that the pressure of market forces is the main determinant of banks' capital requirements. This finding is in clear contrast with the findings of (Kim and Santomero, 1988) who showed that tight capital regulations encouraged banks to reduce their credit facilities which adversely affected the level of productive investments. (Gonzalez, 2005) also examined the impact of bank regulation on bank risk-taking using a panel of 251 banks from 36 countries using a two-stage least squares method. The findings show that regulatory restrictions influenced banks' risk-taking behavior though this was inconsistent. (Uhde and Heimeshoff, 2009) examined the effects of capital regulation on the European bank's stability for the period 1997 -2005 and found Eastern European banking markets to be less diversified and more concentrated. These markets are more prone to financial fragility. The findings also showed that market concentration harmed European banks' financial soundness.

(Stolz and Wedow, 2011) analyzed the effect of the business cycle on the regulatory capital buffers of German local banks for the period 1993-2004 using GMM method. They report that capital buffers behaved counter-cyclically and that the results varied depending on the level of bank capitalization, where less-capitalized banks decreased capital buffers and raise risk-weighted assets over the business cycle while well-capitalized banks maintained capital buffers and risk-weighted assets in booms and increased capital buffers by accumulating capital and lowering risk-weighted assets during the market downturn. (Teixeira et al., 2014) investigated the impact of capital requirements on banks' equity capital using panel data for a sample of 560 banks from the US and Europe. They found that regulatory capital requirements are not the main determinants of banks' capital structure. According to the type and region of the bank, the determinants of the banks' share of equity vary. Based on the work (Blundell and Bond, 1998), (Abreu and Gulamhussen, 2015) examined the impact of the new Federal Reserve (FED) regulations on capital levels and buffers held by banks before the U.S. financial crisis using a sample of 4433 banks. They found that the Federal regulations failed to force the banks to build capital buffers or alter

their adjustment speeds during the economic upturn that preceded the crisis. (Rahman et al., 2015) using a panel dataset of 30 Bangladeshi commercial banks for the period 2008-2012, examined the impact of bank size on bank regulatory capital ratios and risk-taking behavior by employing GMM and simulated equation models. They found that large banks are riskier and have a higher level of capital relative to their smaller counterparts and that bank risk exposure decreased with a high level of regulatory capital. (Ashraf et al., 2016) using annual data consisting of 8689 banks from 58 countries examined whether common equity-based and risk-based capital requirements forced banks to restrict dividend payments or not using the random-effects method. They found that banks paid lower dividends in countries where regulators imposed common equity-based capital regulation but after extending the sample period from 1998 to 2012, they found that regulatory capital requirements are less effective in restricting bank dividend payments during the crisis period.

(Yameen and Ali, 2016) evaluated the financial soundness of thirteen Jordanian commercial banks, between 2002 and 2011. They found that all the Jordanian Commercial banks are financially sound. They concluded that the Bank meter could help the commercial Jordanian banks' internal management to avoid insolvency issues with proper control over their operations. (Al-Homaidi. Etal, 2018) examined the relationship between the extent of voluntary disclosure level and profitability of Yemeni Islamic banks and measure the level of voluntary disclosure information and its association with the profitability of 30 annual reports of Yemeni Islamic banks covering the period from 2005 up to 2014. They found that corporate governance information, corporate social disclosure, bank size and bank age have a negative and significant relationship with return on assets. Concerning (ROE), the results reveal that background about the Islamic bank, financial ratios, corporate governance information, corporate social disclosure, zakat information, and bank size have a negative and significant effect with return on equity.

(Haryanto, 2020) analyzed the factors that affect the profitability of Islamic banks in Indonesia using quarterly data from 2006-2019. He aimed to analyze the effect of efficiency, risk, liquidity, capital and macroeconomic conditions on the profitability of Islamic banks in Indonesia. He found that the efficiency and risk had a positive effect on profitability. Inflation has a negative effect on profitability. While liquidity, CAR and GDP do not affect the profitability of Islamic banks.

2.6 Bank liquidity, liquidity risk, and credit risk literature review

Banks are widely known to experience various types of risk, ranging from interest rate risk to credit risk. Therefore, understanding risks and their impact on bank performance is critical to all banks which also applies to Jordanian banks since banks in Jordan are themselves exposed to different types of risks and because of the important role that Jordanian banks play in the financial system and the real economy. Therefore, if these bank specific risks are not properly managed, they may have untold repercussions for the real economy. It is worth noting that the banking sector in Jordan does not have a functioning credit risk management system to be able to anticipate future risks that might affect the system. As a result, serious events have risen due to such inadequacy. One example of this is the excessive losses incurred by the Housing Bank, which is one of the largest banks in Jordan, a result of the collapse of subsidiaries in neighbouring countries such as Syria. In light of these losses, bank officials confirmed that such losses could have been avoided had there been a functioning credit risk management system in place to correctly anticipate future crises. Therefore, identifying the major type of risks faced by Jordanian banks should assist in helping the Central Bank of Jordan's reform policies in the direction of mitigating these risks while also maintaining the stability of the banking system.

Using annual data of banks in 12 advanced economies during the period 1994-2006, (Chen et al., 2018) employed alternative liquidity risk measures besides liquidity ratio and examined the main drivers of liquidity risk while also using a set of control variables consisting of bank-specific, supervisory and macroeconomic characteristics. The authors used 2SLS IV methods. The finding indicates that liquidity risk reduced profitability due to the higher cost of funds but increased banks' net interest margins. The study classified the financial systems of the countries' in the sample as either bank-based or market-based, and report liquidity risk to be negatively correlated with bank performance mainly in market-based financial systems. (Cucinelli, 2013), using annual data for 1080 listed and non-listed Eurozone banks for the period 2006- 2010, he report that over the long-run well-capitalized banks have large liquidity covers and high-risk exposures and that assets quality, capitalization, size, and specialization are significant factors in planning effective liquidity risk management. (Distinguin, et al., 2013) examined the relationship between bank regulatory capital and bank liquidity using annual data for European and US publicly traded commercial banks for the period 2000-2006 using control variables that include total assets, total loans/total assets, total deposits/total assets, loan loss, provisions/total loans, Tier1 capital/total assets, Tier1 and 2 capital/RWA, ROA, and total interest income/total income.

They employed FE and GMM methods and found banks in their sample to be less likely to regulate capital buffers for the purpose of raising liquidity levels. And considering minimum liquidity ratios concomitant to capital ratios enforced by the Basel Committee on Banking Regulation and Supervision, the findings indicate that small banks tended to strengthen their solvency standards when exposed to liquidity deficits while large banks might underestimate liquidity risks because of their too-big-to-fail status. (Yan et al., 2014) estimated liquidity risk for UK banks' using annual data for the period 1997-2010 by utilizing an exposure-based cash-flow-at-risk (CFaR) approach that has been adopted by a number of international and national banks such Barclays, RBS (the Royal Bank of Scotland's) and Lloyds for liquidity management. The findings showed that in 2011 RBS faced the largest liquidity risk while only HSBC managed to maintain positive CFaR throughout the study period. Over the same period, the most volatile cash flows were observed for Lloyds and Nat-west banks, as measured by the decreasing cash flow at risk as a percentage of expected cash flow. On the same issue, (Roman and Sargu, 2015) examined the determinants of liquidity risk for a sample of banks in CEE countries (Poland, the Czech Republic, Bulgaria, Latvia, Hungary, Lithuania, Romania) using OLS. They report a significant and positive relationship between total capital ratio (TCR) and overall liquidity and, moreover, a negative impact of impair loans on banks' liquidity. The adverse effects of the global financial turmoil and internal macroeconomic downturn were found to enhance the overall liquidity profiles of the banks. Taking a different approach and based on a partial-adjustment model similar to (Berger et al., 2016) using data for 127,828 U.S. banks during the period 1992-2012 looked at how the liquidity management plans changed following the 2008 global financial crises 2008 using FE and GMM. They report that a typical U.S. commercial bank actively managed its balance sheet liquidity and that the implementation of the Basel III 'net stable funding ratio standards' had significant positive effects on bank liquidity management. They also report that the loans-to-core deposits and net stable funding ratio standards are strictly implemented in smaller banks than bigger banks. (Khan et al., 2017) examined the relationship between funding liquidity and bank risk-taking for U.S. bank holding companies using quarterly data for the period 1986-2014 and report evidence which show that banks, in general, with low liquid profiles, have high-risk exposure. (Aydemir and Guloglu, 2017) examined the impact of credit and liquidity risks on banks' spreads during business cycles in emerging markets. Their findings showed that credit risk was more important than liquidity risk in explaining bank spreads and that the spread effects of credit and liquidity risks vary over the business cycle. Interestingly, the findings suggest that during periods of recession, liquidity risk had a larger

significant impact on spreads while during economic booms, credit risk replaced liquidity risk in influencing bank spreads.

(Altarawneh, 2018) investigated the impact of operational risk, credit risk, and liquidity risk on bank performance in Jordan. He found that operational and credit risks have a significant negative relationship with ROA while liquidity risk is found to have an insignificant positive relationship with ROA, the relationship between firm size and ROA is negative while the relationship between bank age and ROA is found to be positively significant, the relationship between management change and ROA is positively insignificant.

2.7 Summary and Conclusion

This chapter presents a survey of the literature underpinning the research contained in this thesis covering a selection of critical studies that have influenced the growing literature on the determinants of bank performance, studies on the impact of capital, capital adequacy requirement, risk-based capital, liquidity risk, capital regulation and other factors on banks' performance measures. Generally, bank performance is affected by internal and external factors. In contrast, changes in bank-specific characteristics such as size, capital and risk management are found to cause significant changes in bank profitability. Liquidity and liquidity risk are also known to adversely affect bank performance, while capitalization, GDP growth and inflation are profitability triggers.

Each of the separate themes of the foregoing literature reveals gaps in the literature, suggesting areas of research using Jordanian data. In this respect and on the issue of risk and capital adequacy requirement. It is the case that the majority of studies investigating the impact of capital adequacy requirements on banks' performance have been more interested in examining bank specific data from developed countries. Most of these studies report that high risk is associated with high capital levels and the adoption of capital adequacy rules may increase bank's riskiness. While other studies have found that the implementation of capital adequacy requirements reduced risk-taking by commercial banks. This ongoing debate is lacking in strong empirical evidence from developing countries, especially Middle Eastern countries.

The Jordanian banking system has a high capital adequacy ratio, which ranged between

18-21 percent. These rates are higher than both the Central Bank of Jordan and the Basel limits of 12 percent and 8 per cent, respectively. Thus, it is of interest to investigate how and how steering capital requirements have helped stabilize and therefore protect Jordanian commercial banks against risks. Similar questions can be raised with respect to the impact of bank risk-based capital on risk exposure and Jordanian commercial bank stability. As this review has shown, the literature in this area is mixed as some studies have found that risk-based capital has had a negative impact on bank performance while other studies report that it has enhanced stability. Other studies have also looked at the impact of risk-based capital on bank lending behavior and report a minor impact on loan growth. Since high risk-based capital levels make lending more expensive. In line with risk-based measures, the literature on the criticality of liquidity and credit risk in influencing bank stability support the existence of a positive relationship between liquidity and credit risk, especially after the 2008 crisis, where liquidity risk has been shown to be one of the main reasons for bank failures. Regarding the impact of capital regulations on the banking sector behavior, one strand of the literature suggests that capital regulation reduces asset risk, while another strand suggest that adopting capital requirement regulations increases the chance of bank failure. Bank capital and operational efficiency are also considered important risk determinants. And the literature in this area has shown that capital regulations improve banking sector stability because it helps to foster the efficient allocation of risks while also supporting financial stability.

The empirical study set out in each of the subsequent chapters fills an important gap in the literature on bank performance determinants by considering the impact of bank-specific, market structure and macroeconomic variables on different profitability measures for a sample of 13 Jordanian banks for the period 2003-2015. In this respect Chapter 4, investigate the profitability of Jordanian banks in light of bank reform and the deregulation programs, and looks at the impact of competition, risk, and interest rates on bank performance. Chapter 5 studies the relationship between Jordanian banks' capital, risk, and efficiency, while Chapter 6 examine the impact of Jordanian banking system efficiency and competition on the cost of credit. Chapter 7 examine liquidity funding risk and the impact of the deposit insurance scheme on the risk-taking behavior of Jordanian banks.

In consideration of the gaps in the literature previously mentioned, the study seeks to answer the following research questions:

- How and in what ways have the competitive conditions affected the profitability of

Jordanian banks?

- Does liquidity risk influence the profitability of Jordanian banks?
- To what extent have changes in interest rates affected the profitability of Jordanian banks?
- Which market type monopoly, monopolistic competition, or perfect competition, best represents the Jordanian banking sector?
- Does bank capital affect the risk-taking behavior of Jordanian banks?
- Does bank capital affect the efficiency of Jordanian banks?
- To what extent does risk affect the efficiency of Jordanian banks?
- Does bank size affect liquidity funding?
- Does capitalization affect the liquidity funding requirement of Jordanian banks?
- To what extent have crisis periods affected the liquidity funding requirements of Jordanian banks?
- Does the size of a bank affect its liquidity creation?
- Does bank capitalization affect liquidity creation?
- To what extent has crises periods affected the liquidity creation of Jordanian banks?

In relation to these questions, we hypothesize that:

H1.1: There is a positive relationship between bank competition and profitability.

H1.2: There is a significant positive relationship between liquidity risk and profitability.

H1.3: There is a positive relationship between the interest rate and profitability.

H2.1: There is a positive relationship between bank capital and efficiency.

H2.2: There is a negative relationship between risk and bank efficiency.

H2.3: There is a negative relationship between capital and risk.

H3.1: There is a negative relationship between bank efficiency and the cost of credit.

H4.1. Lower funding liquidity risk incentivises banks to take more risk.

H4.2. Banks with higher capital buffers are less risk-taking in response to lower funding liquidity risks.

H4.3. Larger banks take less risk in response to lower funding liquidity risk

H4.4. In response to reductions in funding liquidity risk, bank risk decreased during the Global Financial Crisis.

In this section we will focus on the theories related to that have been developed over the years by researchers in banking and related to the study objectives and hypotheses.

Conducting research on the performance of the banks begin between 1970 and 1980. They applied efficient structure theory and market power theory (Athanasoglou et al., 2006). Portfolio theory as well helps in determining banks' profits and used in the study of the profitability of banks (Nzongang and Atemnkeng, 2006). The bank performance is affected by the market structure of the industry stated by market power theory which was given by (Tregenna, 2009). The SCP and the RMP theorem are the two different approaches of the market power theory. Efficiency theory states that banks are more efficient earn more profits and it possesses two different approaches named as Scale efficiency hypothesis and X efficiency. X efficiency states that efficient firms have lower cost hence, they are more profitable than others. On the other hand, approach of Scale efficiency focuses on high scale production and ignores any differences in management and technology of production. Large firms size has the benefit of economies of scale which produce higher profit as a result to the low per-unit cost. Hence, they have a high market share which leads to higher profits (Athanasoglou et al., 2006). Balanced portfolio theory also plays a vital role in the study of the performance of the banks. (Nzongang and Atemnkeng,2006). This theory states that decisions regarding the policy affect the optimal presence of each asset in the investment of shareholder which affected by factors such as rate of return, size of the portfolio and risks associated with the holding of each asset. High profits can be achieved by a possible set of liabilities and assets which are recognized by management and expenses incurred by banks. Bank performance affected by risk-return trade-off and the equity to asset ratio. According to financing theory, high levels of debt and low value of equity to asset ratio results in high risk which results in high rates of return which also explains the risk-return trade-off theory (Van Ommeren, 2011). Some studies explained that higher profits can be fetched by high equity to asset ratio. The market value of the bank increases with high equity ratio according to the signalling hypothesis

(Berger, 1995). On the other hand, bankruptcy cost hypothesis states that banks hold high equity as a result of unexpectedly high bankruptcy costs to avoid financial debt (Berger, 1995).

Starting with the literature assessing competition in the banking sector. They are divided into two types of research: (1) studies that adopt a structural approach and (2) studies that adopt a non-structural approach. The structural method has its roots in the theory of industrial organization that measures competitiveness following the Structure-Conduct-Performance (SCP) paradigm and the alternative efficiency hypothesis (EH). The SCP paradigm, having its origin in the work of (Bain, 1951). In our study, we employ one of the "Non-Structural Model" approach suggested by (Rosse and Panzar 1977) and Panzar and Rosse (1982, 1987) which used by several scholars to determine the structure of the banking market in some countries and its impacts on the bank profitability. In Jordan, we used the Panzar-Rosse assessment as it is the appropriate method that complies with the available data. (Gilbert, 1984), pointed out that a major weakness in most bank market structures studies is the absence of a theoretical foundation which takes account of bank regulation when considering the effect of market structure on bank profitability. The competition-efficiency hypothesis recommended that efficiency leads to reduce banks' costs which further proceed to higher profitability. Conversely, studies in favour of SCP hypothesis suggested that less competition in banks tend to expand their business activities and higher profitability.

The risk- aversion hypothesis was first introduced in the manufacturing industry by (Galbraith, 1967) and then expanded by (Cave, 1970). The Galbraith- Cave or risk avoidance hypothesis as referred by (Edwards and Heggested 1973) indicates that banks located in more concentrated markets may choose to trade off some of their potential monopoly profit for reduction in risk by choosing safer portfolios. Thus, (Clark, 1986) had indicated that selecting a safer portfolio of assets and liabilities in line with their risk-preference, banks located in concentrated markets with monopoly power, may reduce risk at the expense of some monopoly profit. Hence, the risk avoidance hypothesis may provide an explanation for the lack of relationship between concentration or monopoly power and profitability. (Clark, 1986) also analyzed the existence of a systematic interrelationship between market concentration, risk and profitability as suggested by the risk-avoidance hypothesis. He argued that asset and liability portfolio selection, risk and profitability are interrelated and hence determined simultaneously. Thus, he estimated a simultaneous equation model by using the two-stage least squares technique. The results indicated that concentration had a significant negative effect on overall bank risk and a significant positive effect on profitability. (Kushner et.al, 1989), examined the

impact of firm size on the profit rate and the level of risk for chartered banks and the national trust and loan companies in Canada. The 10 firms used for the study account for more than 75 % of all trust companies' assets in Canada. Results somewhat showed mixed support for the Galbraith-Caves hypothesis. Firstly, the results did not support the hypothesis that larger firms can reach desirable sets of profit and risk. However, it is suggested that larger firms and firms with greater market power operate at lower levels of risks. These findings provide evidence in favour of the risk-avoidance hypothesis among large commercial banks in addition to demonstrating the importance of risk as a determinant of bank profitability. The implication of the presence of risk-avoidance behaviour in the banking industry is that credit will only be extended to safe business firms which are usually large establishments in monopolistic markets. Several possible explanations have been put forward for the bank's risk adverse behaviour. (Vernon, 1971), pointed out that banks are generally controlled by managers rather than owners. These managers do have considerable control over the risk exposure of their banks in their daily portfolio decisions. However, the adverse effects of an unsuccessful managerial decision may far outweigh the rewards for a successful management decision. As a result, a major impact of managerial control in banking is a tendency is for more risk adverse behaviour. To this extent, (Edwards and Heggestad, 1973) found that the degree of risk, as measured by the coefficient of variation of large banks‟ profits over time tends to fall significantly as the level of concentration in the respective bank's market increases. Thus, providing further support for the risk avoidance hypothesis. Another possible explanation provided by (Heggestad, 1977) was that the banks‟ risk adverse behaviour may be a consequence of regulation, since one of the main objectives of bank regulation is to limit the risk exposure of banks by restricting their portfolio choices. Effective portfolio regulation would thus constrain banks to safer portfolios and thus provide apparent evidence in favour of the risk-avoidance hypothesis. The structure-conduct-performance hypothesis states that highly concentrated markets positively impact bank profitability through greater market power and therewith the ability to charge high rates for loans and low rates for deposits. Empirical evidence for the structure-conduct-profit hypothesis is found in (Goddard et al., 2004) for Europe. On the other hand, the efficient-structure theory claims that greater market shares are gained from higher efficiency which increases profitability, see (Berger, 1995). The theory of capital structure states that a higher use of debt (equity) financing within a certain range, might actually reduce (increase) firms' cost of capital. Thus, a positive (negative) coefficient estimate for equity-to-assets indicates an efficient (inefficient) management of banks' capital structure. Besides efficiency, competition between banks can influence the stability of the sector (Carletti and

Hartmann, 2002). The link between competition and financial stability has been recognized in theoretical and empirical research. Indeed, competition affects the stability of the sector in the sense of either fragility or excessive risk-taking (Geraldine and Weill, 2008).

Balanced portfolio theory also plays a vital role in the study of the performance of the banks. (Nzongang and Atemnkeng,2006). This theory states that decisions regarding the policy affect the optimal presence of each asset in the investment of shareholder which affected by factors such as rate of return, size of the portfolio and risks associated with the holding of each asset. High profits can be achieved by a possible set of liabilities and assets which are recognized by management and expenses incurred by banks. Bank performance affected by risk-return trade-off and the equity to asset ratio. According to financing theory, high levels of debt and low value of equity to asset ratio results in high risk which results in high rates of return which also explains the risk-return trade-off theory (Van Ommeren, 2011). Some studies explained that higher profits can be fetched by high equity to asset ratio. The market value of the bank increases with high equity ratio according to the signalling hypothesis (Berger, 1995). On the other hand, bankruptcy cost hypothesis states that banks hold high equity as a result of unexpectedly high bankruptcy costs to avoid financial debt (Berger, 1995).

From a theoretical point of view, sound competition in the banking market is of great economic importance as it is lowering prices and improves the quality of services and performance. The degree of competition in the financial sector can influence the efficiency of the production of financial services (Jiménez et al., 2007). Increased competition in the financial sector to lead to lower costs and enhanced efficiency and profitability. Furthermore, competition can affect the quality of financial products, it forces banks to improve their efficiency, thus will help households and firms access to financial services and finance, which improve profitability and economic growth. Moreover, the higher the degree of competition in the banking sector, the higher its efficiency in allocating funds and operating as an intermediary between lenders and borrowers (De Nicolò and Loukoianova, 2007).

According to financing theory, high levels of debt and low value of equity to asset ratio result in high risk, resulting in high rates of return, which also explains the risk-return trade-off theory (Van Ommeren, 2011). Some studies explained that higher profits can be fetched by high equity to asset ratio. According to the signalling hypothesis, the market value of the bank increases with high equity ratio (Berger, 1995). On the other hand, bankruptcy cost hypothesis

states that banks hold high equity as a result of unexpectedly high bankruptcy costs to avoid financial debt (Berger, 1995).

CHAPTER 3

Background to the Jordanian Banking Sector

3.1 Introduction

The theoretical structural model implies that the financial system is included in one of many factors that can be treated as economic growth determinants as the institutional framework of the financial system and its performance is also an important determinant of economic growth. its stability and development have a positive impact on economic growth. However, when verifying this hypothesis, some questions appear: Is the relationship between the financial sector and economic growth strengthened after the last global crisis and the crisis? (Matysek-Jedrych, 2007) define the financial system as it is the structure of ‘‘interconnected financial institutions, financial markets and elements of financial system infrastructure; through this structure, entities belonging to the real environment (first of all households, enterprises and government) can source funding, invest savings and satisfy the rest of their needs relating to the financial aspect of their functioning’’ (Matysek-Jedrych 2007).

As one of the financial system main drivers of the economy is the banking system. Many of the economics is a bank-based financial system. The bank is a financial institution involved in borrowing and lending money. It plays an important role in the economy by offering a service of saving and financing for household, people, business, and government. These services, such as providing loans, are essential for enabling economic growth. The banking system consists of banks such as commercial banks, investment banks, Islamic banks, agriculture and industrial banks. Commercial banks play an essential role in the banking system and the economy, a vital component of the financial system. One of the main functions of commercial banks is to allocate funds from savers to borrowers efficiently by providing different and specialized financial services. These financial services help to make the overall economy more efficient.

(Werner, 2012) shows that the macroeconomic feedback of banking activity had been neglected. The study that one of three theories of banking has been dominant: The credit creation theory of banking maintains that through accounting operations each bank can individually create money out of nothing. The fractional reserve theory states that only who can collectively create money is the banking system as a whole, and they are a financial

intermediary, gathering deposits and lending money. The third one is the financial intermediation theory which considers banks as financial intermediaries both individually and collectively, showing that the bank banks are indistinguishable from other non-bank financial institutions in their behaviour.

The first empirical test published on this issue was (Werner, 2014b), who examine the actual operations and accounting entries taking place when a 'live' bank loan is granted and paid out. He found that only the credit creation theory was consistent with the observed empirical evidence. Previous literature discussed the linkage between banking sector development and economic growth and confirmed that the banking system financing enhance and improve economic growth. (McKinnon, 1973) found that increases in banking services and financial activities are accelerating economy toward growth. (King and Levine, 1993) argued that providing more funds to the economy stimulates the movement of economic wheels. Using a data for in emerging and developed countries, (Hshin-Yu Liang and Alan Reichert, 2006) examined the relationship between banking system development and economic growth and found a strong supply–leading relation between banking sector development and economic output. Moreover, for 10 Europeanan Union countries throughout 1994 to 2007, (Caporale M. et al, 2009) found that stock and money markets are still underdeveloped and their contribution to economic growth is limited, whilst banks enhanced economic growth.

In developing countries, using a data that covered the Palestine banking system during the period of 1995 to 2011, (Alfara, 2012) discussed the role of the banking sector in financing economic development and found that banking credits have a positive effect on gross domestic product. While in some neighborhood countries, (Owdeh, 2012) studied the relationship between banking sector growth and economic development in Lebanon and found a positive impact on the role of the banking system in economic growth. Similarly, (Al-Khatib and Al-Saffar, 2013) examined the relationship between financial development and economic growth in Jordan and found that banking sector development and economic growth has a strong demand-leading relationship and the banking system development is significantly influenced by economic growth.

The previous literature suggested that both bank-specific factors (internal) and macroeconomic factors (external or environmental), may have an influence on the bank's performance (Bourk,1989). The importance of that analysis of both bank-specific factors (internal) and macroeconomic factors (external or environmental) on the bank's performance should be carried out, which will help decision-makers improve banks' performance by

manipulating internal by mitigating/capitalizing on the influence of external factors.

The theoretical and empirical studies show that the banking system affected by various internal and external variables (Ugwunta et al., 2012). Bank characteristics divided into internal and external factors. Internal factors include capital adequacy, cost to income ratio, liquidity; calculated as loans to customers, and the accounting value of the bank's total assets and external factors, including the annual inflation rate and real gross domestic product growth. The internal factors are those that can be controlled by the bank management and influences decision-making. While external factors are those factors that cannot be controlled by bank management and influence decision-making. However, managers can analyze the external factor and environment to benefit from any changes that could be happened.

Over the last years of the deregulations and the economic reform program since 1980, a number of factors have contributed to the Jordanian banking system performance (internal and external). For example: In regards to increasing the sector competition, the CBJ attempt to use deregulation, reform program, and liberalization that promoted by the Central Bank Directive on the banking system. This directive provides the competitive conditions for all Jordanian banking institutions, which will influence banks' profitability. It has its important for stakeholders such as the central banks, governments, bankers' associations, and other financial authorities and the managers of the banks. the mentioned steps that carried by CBJ it has its role to improve and enhance the economic growth as well. Previous work such as (Pasiouras and Kosmidou, 2007); (Rajan and Zingales, 1998); and (Levine, 1998) work, show the impact of both internal and external factors on the banking performance.

The banking sector in Jordan is the cornerstone of the Jordanian economy. This is because when the real economy was left shaken by the global financial crises of 2008, the banking sector not only showed considerable resilience also provided much needed liquidity that enabled the economy to withstand the spillover effects of the negative externalities brought about as a result of the fallout from the U.S. subprime crisis. Since the beginning of the 1990s and the launch of the joint venture of the Central Bank of Jordan (CBJ) and the World Bank (WB) to reform the banking sector following the 1980s crises, the banking sector continued to grow and with that growth has attracted interest from both domestic and international investors.

The Jordanian banking system consist of the CBJ including Islamic banks, foreign

banks, commercial banks, specialized lending institutions, real estate institutions, saving and other financial institutions, specialized credit institutions, housing banks, and money-changing companies. In 2010, the number of working banks stood at 25, including 3 Islamic and 9 foreign banks. Over the years, Jordanian banks have accommodated the financial needs of individuals and large corporations and, as a result, has the highest concentrations of credit payments covering trade, construction, and industry sectors. In terms of total bank equity, since 2007, the banking sector has experienced continued growth. This has enabled the sector to support bank lending activity on the one hand, and on the other to support increased non-distributed bank earnings and the demands of the new minimum capital requirements of the CBJ.

As is the case in all developed and developing countries, the primary objectives of commercial banks in Jordan is to maximize shareholder profit. But unlike conventional profit-seeking banks, Jordanian banks face several types of risk while undertaking banking operations and also operate in a highly regulated legislative environment which is designed to maintain the safety and soundness of the banking system. The purpose of this chapter is to give a brief overview of the developing banking sector in Jordan and thereby provide the context underpinning the study carried out in this thesis. This is discussed in the next section, which provides an overview of the development of the Jordanian banking sector starting from the 1990s, including a brief discussion of the evolution of the CBJ and CBJ regulations in light of the Basel accords. The structure of this chapter divided into 4 sections as follows: Section 3.1 introduction. Section 3.2 present the overview of the banking system in Jordan. Then in section 3.3, we apply indicators of financial soundness to discuss the development of Jordanian banks' assets and liabilities over the period 1993-2015. Section 3.4 concludes the chapter.

3.2 Overview of the banking system in Jordan

In the last century, the Jordanian banking sector was founded when the British Othoman Bank became the first bank to commence banking operation in Jordan in 1925. The Ottoman Bank operated solely in the market until 1935 when the Arab Bank Limited opened its first branch in Amman at the end of 1934 (The Ottoman Bank changed its name in 2003 to the Standard Chartered Bank). However, due to the political instability in Palestine, the Arab Bank was forced to relocate its headquarters to Amman. On 14 April 1949, two more banks were

established, the British Bank for the Middle East and the Arab Nation Bank (ANB). Initially, the ANB did not practice banking activities and, as a result, was liquidated. In 1957, the Arab Real Estate Bank commenced conventional banking activities in Jordan as a commercial bank and also provided specialized real estate finance services. Five more banks were later established in the 1950s – the Jordan National Bank, Cairo Amman Bank, Rafidain Bank, Saudi Riyadh Bank, and Intra Banks. Since the Saudi Riyadh Bank did not engage in bank related activities, its registration was cancelled. In contrast, the activities of Intra Bank were suspended as a result of its insolvency in 1970. However, it was later re-established in 1977 under the new name of Al-Mashreq Bank following the merger with Jordan Bank when the latter was liquidated in 1989. In addition, three specialized government owned credit institutions were established in 1960 – the Agriculture Credit Corporation, the Housing and Urban Development Corporation, and the Cities and Village Development Corporation, and in 1961 the Holy Land Bank registered a domestic bank but its registration ceased in 1965. Barclays Bank was one of the earliest foreign banks to operate in Jordan, followed by HSBC Bank in the late 1950s.

Until 1964, the Jordanian monetary board did not exercise any influence over the Jordanian banking sector. It was only when the CBJ was established in 1964 as an independent legal entity owned by the Jordanian government that the CBJ obtained powers that made it the only official monetary authority of Jordan. The CBJ is managed by a board of directors who are appointed by the council of ministers. Its main role is to administer monetary and credit policies, as well as to ensure the day to day stability of the Jordanian banking and financial system.

In the 1970s, five banks were established: one Islamic bank (Jordan Islamic Bank for Finance and Investment) and four domestic banks (Jordan Kuwaiti Bank, Housing Bank for Trade and Finance, Arab Jordan Investment Bank, and Jordan Gulf Bank, known now as Jordan Commercial Bank). Two more domestic banks (Arab Banking Corporation and Jordan Investment and Finance Bank) were established in the 1980s. In the 1990s, four banks were established, including one Islamic (Islamic International Arab Bank Plc) and three domestics (Union Bank for saving and Investment, Société Générale De Banque-Jordanie, and Export and Finance Bank). During the 2000's, seven banks were established, including a local and six foreign banks(Standard Chartered Bank, National Bank of Kuwait, Audi Bank, BLOM Bank, Jordan Dubai Islamic Bank, National Bank of Abu Dhabi, and Al Rajhi Bank). The CBJ supervised all banking operations in Jordan.

Over the period 1927-2017 structural changes and mergers and acquisitions have helped reshape the banking system in Jordan. The most notable restructuring was the Arab Banking Corporation of Bahrain (ABC) which converted to a commercial bank with a capital of 10 million Jordanian Dinar (JD) following the restructuring of the Jordan Securities Corporation in 1989. On June 25, 2014, the Arab Jordan Investment Bank (AJIB) announced the takeover of HSBC Middle East Limited banking operations as part of its strategy to expand its operations. Other banks, such as the Jordan Gulf Bank changed its name to the Jordan Commercial Bank in 2004, while in 2005 the Export and Finance Bank changed its name to Capital Bank. Table 3.1 lists the banks currently operating in the Jordanian banking system.

Table 3.1 Profile of the Jordanian Banks Until 2015.

Bank Name	Origin	Year of establishment	Type	Number of ATM	Branches
Arab Bank	Local	1930	Commercial	151	75 inside 116 outside
Arab Banking Corporation	Local	1989	Commercial	51	27 inside
Arab Jordan Investment Bank	Local	1978	Commercial	51	18 inside 1 outside
Bank Al Etihad	Local	1991	Commercial	59	38 inside
Bank of Jordan	Local	1960	Commercial	118	70 inside 14 outside
Cairo Amman Bank	Local	1960	Commercial	165	72 inside 22 outside
Capital Bank of Jordan	Local	1996	Commercial	38	12 inside
Invest bank	Local	1989	Commercial	28	11 inside
Jordan Ahli Bank	Local	1956	Commercial	100	56 inside 6 outside
Jordan Commercial Bank	Local	1978	Commercial	45	27 inside 4 outside
Jordan Kuwait Bank	Local	1977	Commercial	83	56 inside 3 outside
Societe Generale de Banque Jordanie	Local	1993	Commercial	17	17 inside
The Housing Bank for Trade and Finance	Local	1974	Commercial	214	113 inside 14 outside
Jordan Islamic Bank	Local	1978	Islamic	169	73 inside

Jordan Dubai Islamic Bank	Local	2009	Islamic	35	21inside
Islamic International Arab Bank	Local	1997	Islamic	57	41 inside
Banque Audi	Foreign	2004	Commercial	25	13 inside
Blom Bank	Foreign	2004	Commercial	14	14 inside
Citi Bank	Foreign	1974	Commercial	0	2 inside
Egyptian Arab Land Bank	Foreign	1951	Commercial	14	10 inside
National Bank of Abu Dhabi	Foreign	2009	Commercial	4	3 inside
National Bank of Kuwait	Foreign	2004	Commercial	6	3 inside
Rafidain Bank	Foreign	1957	Commercial	0	2 inside
Standard Chartered	Foreign	2002	Commercial	8	6 inside
Al Rajhi Bank	Foreign	2011	Islamic	36	6 inside

Source: ASE (2015), CBJ (2015); ABJ (2015)

3.2.1 Composition of Jordanian financial sector

The Jordanian banking sector has three types of banks: commercial banks, Islamic banks, and investment banks. These banks are regulated by the CBJ, with the exception of foreign banks, who remain subject to their home country regulations. Commercial banks are banks that deal with traditional borrowing and lending functions while Islamic banks are banks that offer services and products in accordance with Islamic practices and Shariah Laws. These banks incur more operational costs than the other Jordanian banks as a result of their role in financing social services, while their depositors share in the profit and loss of their operations. Investment banks are, however, more specialized and are involved in selected capital market activities such as the issuing, distribution and selling of securities, brokerage services and the underwriting of new share issue and debt. All of these banks, except foreign banks, are listed on the Amman stock market.

In Jordan, commercial banks dominate the banking market. The average total assets of commercial, investment, and Islamic banks are approximately 80 percent, 10 percent, and 10 percent respectively. Of these banks, commercial banks play the largest role in the economy by virtue of their ability to finance various economic sectors, individual and corporate agents. The operation of investment banks is, however, limited and tend to be more focused on proprietary trading and brokerage services. The reasons for this can be explained by their underdeveloped operations, and by the small daily trading volume of the Amman stock market.

With regard to bank ownership, domestic banks are owned by Jordanians and foreign resident's while foreign banks are fully owned by foreign residents. Article 4 of the 2000 Banking Law states that "no person shall engage in banking activities without first obtaining a final license from the Central Bank, in accordance with the provisions of this law''. The minimum capital required by a foreign bank to operate in Jordan is 50 million JD. Before 1997, foreign ownership of domestic banks had a ceiling of 49 percent, but following the removal of capital restrictions in 2006, the foreign ownership ceiling was raised to 55 percent of the total assets of Jordanian banks. At the end of 2014, the total foreign ownership ratio, Arab and foreign, in Jordanian licensed banks' capital was 47 percent.

3.2.2 Restructuring the Jordanian banking sector: banking crisis and financial liberalization.

Prior to the 1980s, the banking sector in Jordan was heavily regulated to protect the domestic banking market from foreign competition. This suggests that Jordanian commercial banks operated in an oligopolistic environment whereby the interest rates on both credits and deposits were determined in a monopolistic manner. Over the period 1988–1991, following the devaluation of the JD, interest rates were raised to encourage savings. But as a result of the collapse of Petra Bank and six other financial institutions linked to it, the banking system suffered a crisis which ultimately dented the confidence of savers in August 1989. The main reasons for the crisis and the lack of savers confidence were due to inadequate banking regulations, which fostered widespread fraud (since the monitoring authority were preoccupied with ensuring that Jordanian banks comply with operating ratios, while at the same time imposing credit limits in order to force banks to do proper risk credit analysis of their loan portfolios), the high level of non-performing loans resulting from the overexposure of banks to the real estate market, and the speculative activities of banks in the foreign exchange market which resulted in excessive exposure and losses.

In 1989, the Jordanian government, with the assistance of the International Monetary Fund (IMF) and the World Bank (WB), launched a reform program aimed at restructuring the banking sector. These reforms gave new powers to the CBJ, including responsibility for monetary policy and stability, determining the size, cost, and direction of credit facilities and the restructuring of banks financial portfolios. In parallel with these reforms, in 1993, the Jordanian government began the process of liberalising the banking system by removing restrictions on the entry of foreign banks (thereby increasing competition), reducing

government direct lending, expanding product deregulation, reducing restrictions on foreign exchange transactions and the de-regulation and liberalization of financial markets. In line with the wholesale reforms, all licensed banks and financial companies were instructed by the CBJ to deposit 35 percent of their total deposits as a required reserve ratio in order to enhance soundness and confidence in the banking industry. 1992, the CBJ instructed all commercial banks to restrict the maximum credit in local currency to 5 percent of their total credit facilities, and in 1997 the CBJ increased the minimum paid-up capital for all domestic banks to JD 20 million, and foreign banks to JD 10 million. This was later increased to JD 40 million.

In 1995, the CBJ allowed Jordanian banks to grant loans exceeding 100,000 JD and in 1996 granted banks managers to use 20 percent of their reserve requirements in the inter-bank market and to invest this sum in loans and other investment in order to enhance bank revenues. At the same time, the CBJ reduced the mandatory reserve requirements on foreign currency deposits from 35 percent to 14 percent which gave banks more room to invest this sum. In the year 1997, the CBJ removed all restrictions on foreign exchange systems and also allowed foreign investors to invest over 50 percent of their capital in Jordanian banks. In 2000, a new banking law was introduced by the CBJ to improve the global outreach and scope of local banking services. This law also helped the banking system by protecting deposits, for example, through the creation of the Deposit Insurance Company, and by regulating the practice of e-banking. Continuing with the deregulation of the financial system, in 2000 the CBJ allowed banks to own insurance companies, as well as to decide on the price of commission and other banking fees, and also allowed banks, in 2005, to control the level of credit concentrations and foreign currency activity.

Following the Basel II accord, the CBJ implemented measures designed to equip banks to manage risk based on the best global practices, including also international best practices in corporate governance practices, as advised by the Organization Economic Cooperation and Development (OECD), to strengthen corporate governance in Jordanian banks. As a result, the board of directors of banks were required to adopt clear policy and procedures regarding the treatment of bank customers covering a wide range of bank business including clients' portfolios in foreign currencies. The CBJ also issued a number of instructions related to corporate governance and audit committee that it required the branches of foreign banks operating in Jordan to implement.

In 2007 the CBJ amended the method of calculating bank liquidity to ensure that

commercial banks were equipped to meet all its obligations at maturity. The CBJ followed this action in 2008 with instructions regarding the liquidity of Islamic banks to ensure the safety of their financial position. As a result, Islamic banks were required to maintain cash balances and semi sufficient cash to cover accrued liability, and were prevented from using subsidiaries assets to cover local obligations.

3.2.3 CBJ Regulation and the Implementation of Basel II and III in Jordan

The regulatory powers of the CBJ have evolved over the last 15 years and closely follows the Basel guidelines. The focus of CBJ regulation is on improving the efficiency of the banking system in order to ensure its stability. Regulation is also aimed at providing sound supervision of banking activities, bank reporting and data warehousing through the by adoption of International Accounting Standards (IAS). From the standpoint of capital regulation, the Basel Committee defines the value of equity ratio to be 8 percent of the risk-weighted assets which has become an international standard for banks around the globe. As a result of reforms to the Basel I accord, in 2004 Basel II focused on three risk measures: minimum capital requirements, banks' supervision assessment and market discipline of banks. These measures were designed to create uniform conditions for better risk measurement and the regulation of international competition on the financial markets. As a result, the CBJ has ensured that all banks apply Basel II capital adequacy requirements to hedge against different types of risk, while also instructing banks to steer their capital adequacy ratios according to Basel II guidelines. To ensure compliance, the CBJ conduct regular field visits to all banks. In 2010 the managers of the central banks and supervisory authorities of selected developed countries established a set of protective new regulations to mitigate the adverse effects of the 2008 financial crises and to prevent further bank bailouts of too big to fail institutions. Under the new Basel III framework, banks are required to increase core capital ratio from 4 to 6 percent to ensure not only the efficiency and stability of the overall financial system but also the risk of banks default. Following a study on the impact of Basel III on Jordanian banks, in 2011 the CBJ required all banks to increase the proportion of liquidity coverage. Banks were also required to assess their capabilities with respect to: (a) determining the amount of capital required to meet the physical risks they might experience, (b) forecasting the capital needed to face crises, (c) harmonizing between current reserves and reserves required under the Basel III initiative, and (d) updating the corporate governance.

To strengthen the resilience of the Jordanian banking sector against regional shocks such as the Arab spring and the war in Yemen. New regulatory and structural reforms were

implemented. These include regular stress tests to ensure that banks are adequately capitalized to withstand regional and global shocks and to be able to hedge against various types of risks. Based on these tests, banks have also become more capable of being able to determine their own level of capital and liquidity to protect banking operation

Since 2013, the CBJ has developed and implemented a systematic template of stress test of potential stressful situations based on the IMF methodology known as Next Generation Balance Sheet Stress Testing. This method uses Top-down Macro Stress Testing /Satellite model methodology which considers the impact of macro-economic indicators on non-performing debt ratio and its proportion of solvency (capital adequacy ratio). This new generation of balance sheet frameworks is easy to use, since it is Excel-based, and is also quite flexible as it can incorporate hundreds of banks over a duration of five years and aims to enrich balance sheet tests with portfolio elements in accordance with Basel II and III. This approach integrates assumptions about potential shocks to allow the stress testers to simulate different scenarios, and also translates the simulated response of selected key risk indicators into an economic assessment of solvency (Schmieder et al., 2011).

3.3 Financial soundness indicators of the Jordanian banking sector

3.3.1 Assets, Deposits and Loans Structure

This section provides an overview of the structure of Jordanian banks' assets and liabilities between 1993 and 2015. Total bank Assets in Jordanian banks rose from 5979 JD million in 1993 to 47133.2 million JD in 2015. A series of events triggered substantial changes in the assets/liabilities structure of the Jordanian banking system over the last twenty years including political incidences associated with the Iraq invasion of Kuwait in 1990, the first Gulf War in 1990, and the United Nations (UN) sanctions on Iraq. Major sectors such as transportation, agriculture, and industry were severely affected by the economic sanctions imposed on Iraq, given the close trading ties between Iraq and Jordan which lead to the halt in export and import.

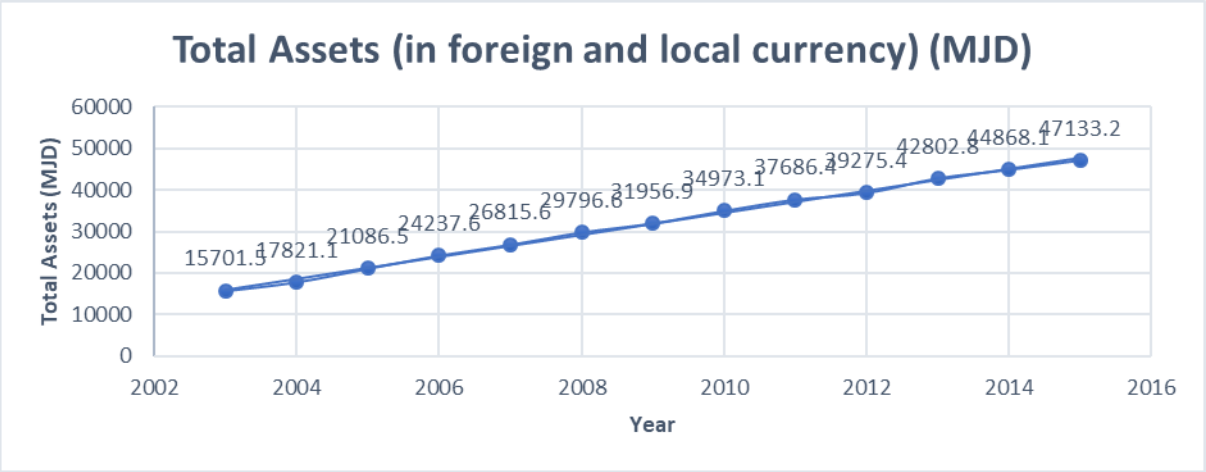
Since 1999, several local financial turmoils' have affected negatively the Jordanian banking sector, including the bankruptcy of the Philadelphia bank in 2002 and some asset quality-related problems at Jordan National Bank, Jordan Gulf Bank, Jordan Investment Bank, and Export Bank in 2001 and 2002 due to provision of loans amounted to 300 million JD to falsified company (Standard and Poor's, 2007). The global financial crises of 2007-2009 also had a serious effect on the operation of the Jordanian banking sector. Before the

crisis, Jordanian banks benefited substantially from the rapid rise in the demand for credit, which was fueled by the economic boom, especially in the real estate sector. But following the 2008 crisis, the CBJ decided to reduce interest rates to boost economic activity· As a result of the low rates on deposits at banks, depositors withdrew their money, which led to a decline in the number of deposits in foreign currency from 5370.1 million JD in 2007 to 4754.1 million JD in 2008. The confidence of Jordanian bank customer only returned when the government declared that it would fully guarantee all bank deposits. At the same time, the CBJ imposed the requirement on Jordanian banks that they should increase their capital (both JD and foreign currency) to cover potential liquidity shortages.

(Alzoubi, 2013) notes that post the global financial crisis, external financing in Jordan became more difficult and expensive, causing shareholders to value cash at a premium since the crisis. In the short-term, the profitability of the banking sector was also adversely affected following the crises (Zeitun and Benjelloun, 2013). With respect to the impact of the financial crisis, (Ahid and Augustine, 2012) note that the impact of the financial crisis on Jordan can be separated into two periods. From April 2008 to December 2008, and from 2008 – 2011. They also noted that during the first period, the impacts of crises were mainly driven by the downturn in the values of grants from developed and international donors who were themselves adversely affected by the crises. And although the CBJ applied some policy measures to protect the banking sector, it had also imposed a much stricter loan classification designed to reduce unnecessary exposure while also setting interest rate at 10.5 percent for housing loans (European economy, 2009). During the second period, all sectors in Jordan had been affected by the crisis, except the banking sector due to the imposed CBJ regulations.

Figure 3.1 shows that just before the onset of the global financial crisis – 2006-2007 – that total assets were 24237.6 and 26815.6 million JD respectively, compared to the period following the financial crisis, 2009 and 2010, 31956.9 - 34973.1 million JD respectively. In 2008, total assets were 29796.6 million JD, a change that was due to the increase in bank capital, deposit growth, the growth of credit facilities to the private sector and the government.

Figure 3.1 Total assets in foreign and local currency (2003-2015).



It is clear from Table 3.2 that the growth of assets, deposits and loans was a direct outcome of the removal of restrictions on investment activities by the CBJ during the period of 1993-2015. Over the same period, Jordanian banks' assets increased significantly, rising from 15701.5 million JDs in 2003 to 47133.2 million JDs at the end of 2015. Bank deposits are generally considered a good indicator of the strength and effectiveness of the banking system.

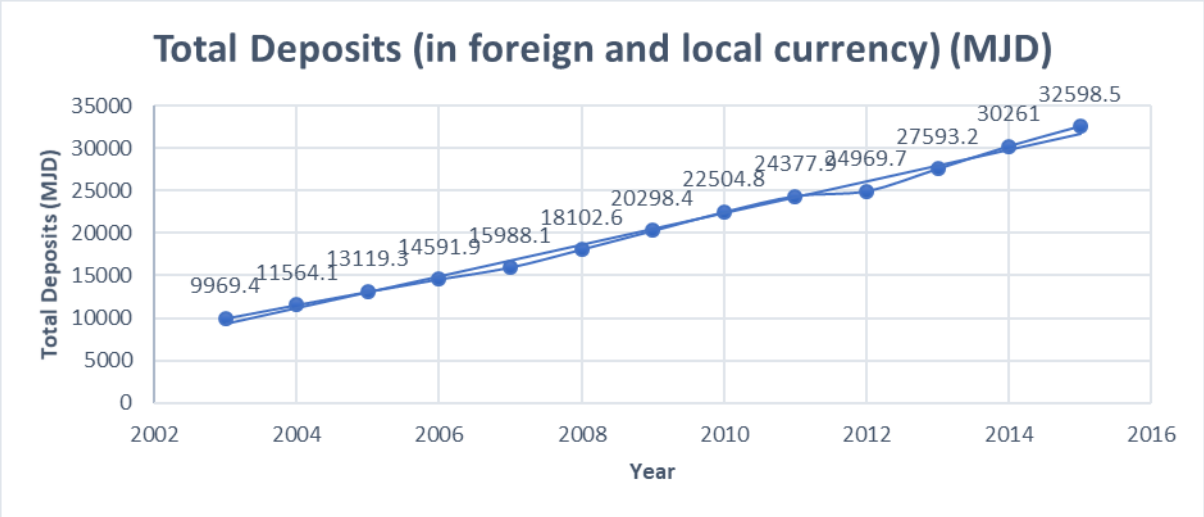
Table 3.2 Assets, loans, and deposits structure for Jordanian Banks 2003-2015.

Year	Total Assets (in foreign and local currency) (MJD)1	Total Deposits (in foreign and local currency) (MJD)1	Total Loans (in foreign and local currency) (MJD)1
2003	15701.5	9969.4	5,262.4
2004	17821.1	11564.1	6,189.2
2005	21086.5	13119.3	7,744.3
2006	24237.6	14591.9	9,761.9
2007	26815.6	15988.1	11,295.6
2008	29796.6	18102.6	13,044.3
2009	31956.9	20298.4	13,317.2
2010	34973.1	22504.8	14451.4
2011	37686.4	24377.9	15851.2
2012	39275.4	24969.7	17829.8
2013	42802.8	27593.2	18939.7
2014	44868.1	30261	19274.5
2015	47133.2	32598.5	21103.5

MJD refers to millions of JDs and the JD equals 1.41US Dollars. Values in nominal terms. Source: CBJ Database 1993-2015

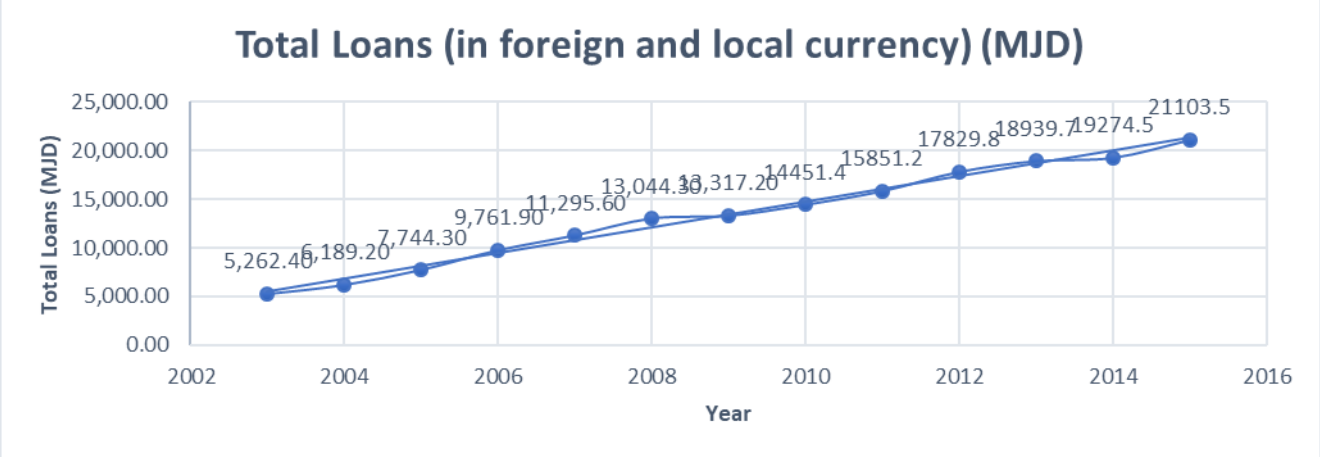
Figure 3.2 shows total deposits in foreign and domestic currency. Over the period 2003-2015 the general trend of the volume of deposits rose and continued its increasing trend from 9969.4 million in 2003 to 32598.5 million in 2015, but these rates slowed as a result of the repercussions of the global financial crisis, as reflected in the decline in interest rate on bank deposits which declined from 5.2 percent at the end of 2001 to 3.46 percent at the end of 2012. The nature of bank deposits suggests that the ratio of the total savings deposits to total deposits is greater than the percentage of total demand deposits to total deposits.

Figure 3.2 Total deposits in foreign and domestic currency (2003-2015).



Another important indicator that reflects the level of financial leverage that the banking sector provides for the whole economy is the domestic credit (loans) index. Credit facilities are also the biggest source of revenue for banks. Figure 3.3 shows the trend of the domestic credit structure granted by Jordanian banks during the period 1993-2015.

Figure 3.3 Total loans in foreign and domestic currency (2003-2015).



The figure shows that total domestic credit increased from 5262.4 million JD in 2003 to 21103.5 million JD at the end of 2015. A fall in credit is observed in 2009 due to the global financial crises. This fall in credit was due to the conservative lending practices of banks and bank lending criteria, as well as the decline in the demand for loans, especially mortgage loans. During 2010-2015 the ratio of credit facility began to grow as a result of the imposition of tighter monetary policy to curb inflationary pressures.

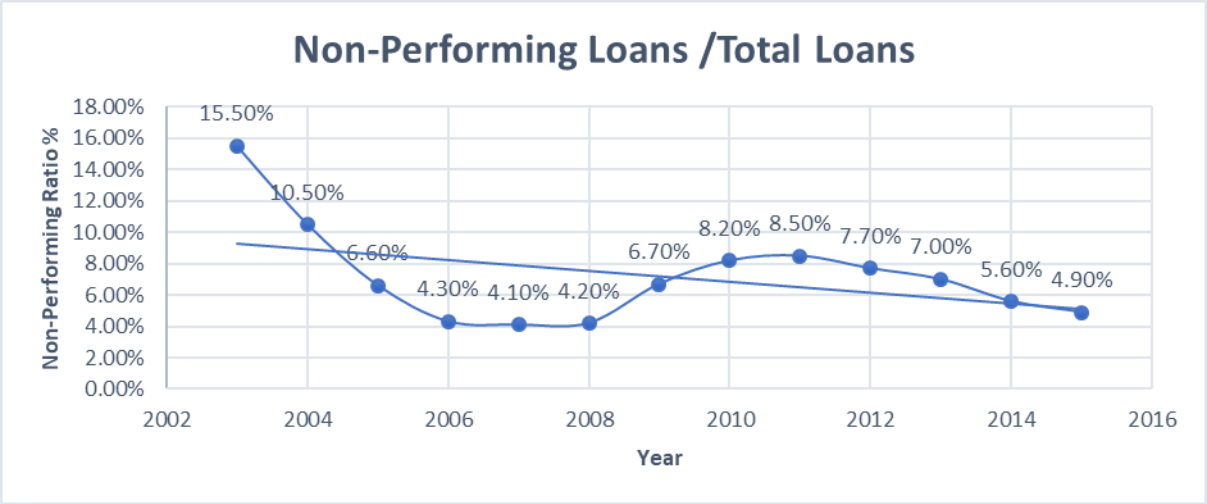
3.3.2 Sources and uses of funds of Jordanian banks

The banking sector in Jordan plays an important role in mobilizing domestic savings and channeling them in the form of loans to different economic sectors. To accomplish this task, funds are divided into external (short or medium termed deposits from inter-bank loans, customers, and loans from the CBJ) and internal (long term subordinated debt by shareholders and banks' capital and reserves) sources. Bank funds are mainly channeled in the form of granted loans for both private and public sectors, purchase of firms', governments' stocks and bonds, to create deposits in local and foreign banks, and the purchase of CBJ ' CD's.

3.3.3 Financial strength indicators for the Jordanian banking sector

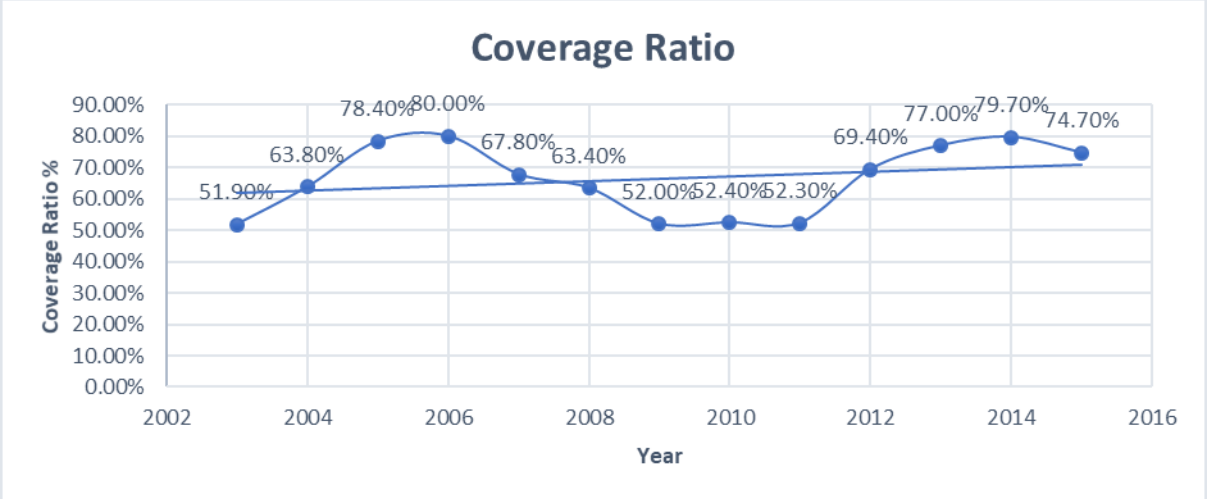
The financial strength indicators assess the resilience of the banking sector to internal and external shocks and risk. Table 3.3 presents the most important strength indicators during the period 2003– 2015. These indicators can be classified into three main groups. "Asset quality indicators", which include the proportion of non-performing debt to total debt and the coverage ratio. Second, "capital adequacy indicators", which include capital adequacy ratio and financial leverage and the last one is "profitability and efficiency" indicators, which include interest margin to gross income, the rate of ROE, return on assets, and the liquidity ratio.

Figure 3.4 Non-performing loans to total loans (2003-2015).



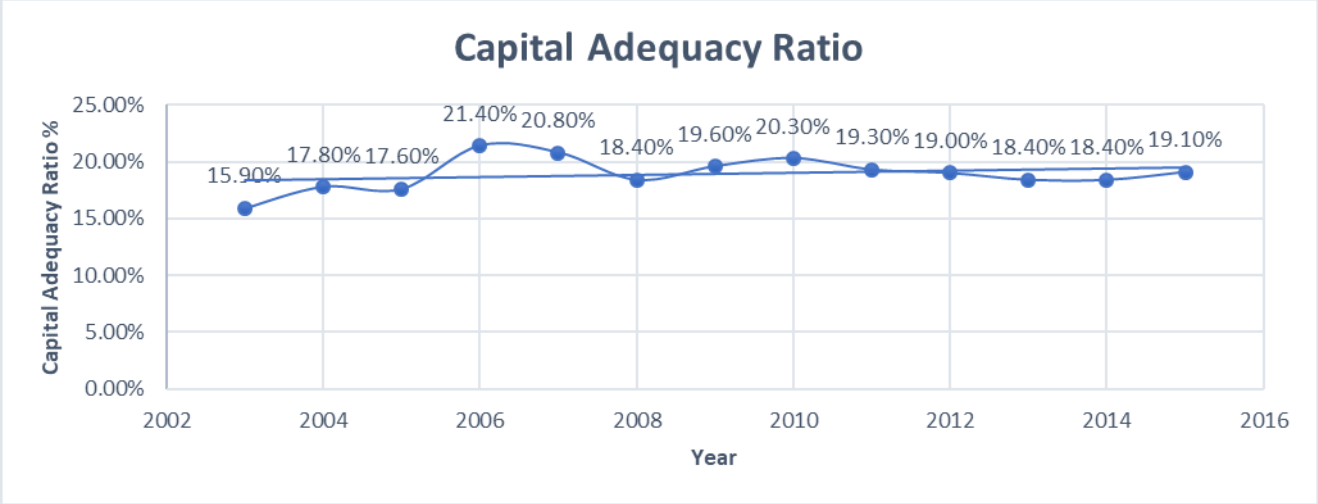
A significant improvement in Jordanian bank assets quality occurred during the period 2003-2015, Figure 3.4 shows there was an intense decline in the debt ratio of non-performing loans/total debt from 15.50 percent at the end of 2003 to 4.2 percent at the end of 2008, with the ratio climbing to an increasing trend in 2011, reaching 8.5 percent. As a result of the outcome from the financial crisis and the political problems in the region – the Arab Spring – bank customer struggled to repay bank loans. However, the ratio began a declining trend from 2012 until 2015 reaching 4.9 percent. This decline in NPLs is attributed to the decision of banks to write off part of their NPLs in exchange for provisions allocated to them. With regard to the coverage ratio which measures a bank's ability to meet non-performing debt. Figure 3.5 shows the increase in the coverage ratio for the period 2003-2015.

Figure 3. 5 Coverage ratio (2003-2015).



The coverage ratio reached its highest level of 80 percent in 2006 before declining in 2009 to 52.0 percent due to the global financial crises, before rising to 79.7 percent in 2014. The ratio rose significantly in 2015 reaching 74.7 percent as a result of the increase in credit facilities. The figure suggests that Jordanian banks were able to maintain adequate provisions to cover more than 60 percent of their debt with the coverage ratio for NPL continuing the upward trend that started in 2011, reaching 74.7 percent at the end of 2015, which is an indication of the continuous improvement in Jordanian bank asset quality.

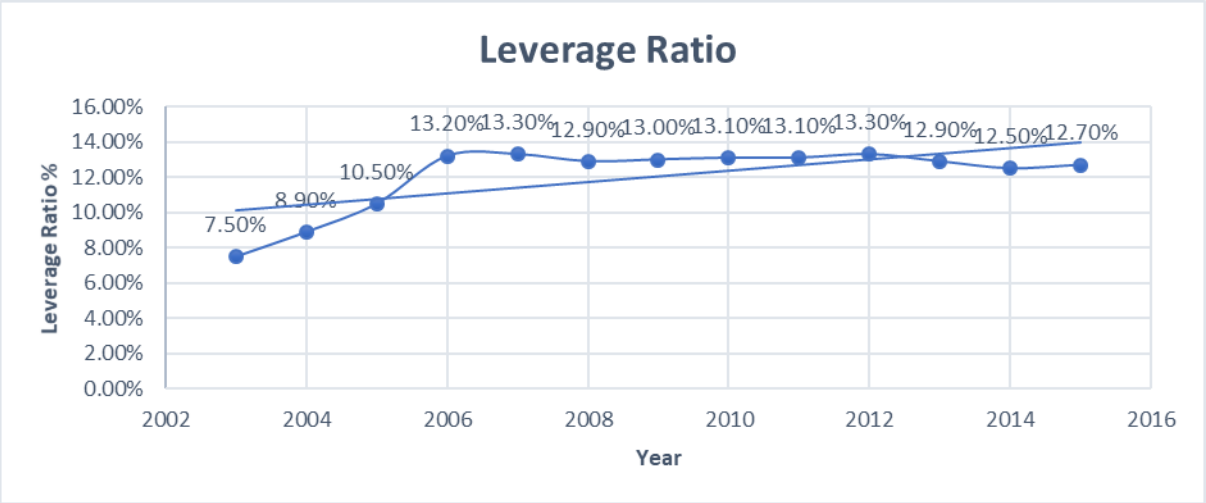
Figure 3. 6 Capital adequacy ratio (2003-2015).



The capital adequacy ratio measures the required minimum capital buffer at banks and thus their ability to function when faced with potential risks. Banks operating in Jordan have been able to cope with a high capital adequacy ratio which amount to more than 7 percent for the period 2003-2015. It is worth noting further that Jordanian banks have always been able to cope with a high mandated capital adequacy ratio that exceeds the minimum required rate imposed by the CBJ (12 percent) and the minimum required rate suggested by the Basel Committee (8 percent) as Figure 3.6 shows. The ratio reached to15.9 percent in 2003 and its highest level of 21.4 percent in 2006. As a result, the economic boom just before the crises that increased banks' capital size and profits. In fact, the ratio began to increase in 2009 reaching 20.3 percent in 2010, despite the fallout from the global financial crisis which resulted a decline in the ratio to 18.4 percent in 2013. This decline was due to the continuous improvement in the credit levels granted by banks to the private sector which usually carries with it relatively high-risk weights. In 2015 the ratio reached to 19.10 percent, which was much higher than the limit set by the CBJ (12 percent) and the limit specified by Basel Committee- Basel III (10.5 percent).

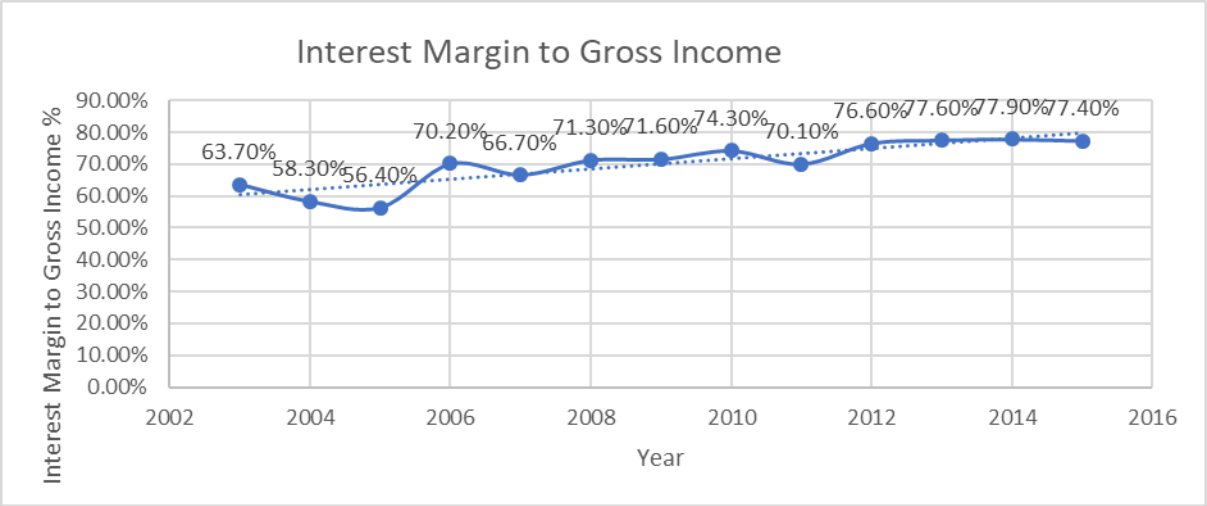
Figure 3.7 shows the leverage ratio for Jordanian banks for the period 2003-2015. The leverage ratio measures how efficient a bank is in financing assets from liabilities and is calculated by dividing shareholders' rights on total assets. As Figure 3.7 shows that percentage grew significantly during the period between 2003-2015, reaching 7.5 percent at the end of 2003 before continuing an upward trend to 13.2 percent in 2007.

Figure 3. 7 Leverage ratio (2003-2015).



As with the other indicators previously discussed, the repercussions of the global financial crises of 2007-2009 are reflected in the decreasing trend of the leverage ratio from the period 2008-2013. In 2014, the ratio decreased to 12.5 percent as a result of the credit facilities expansion before increasing to 12.7 percent in 2015. The high point of the leverage ratio reflects the productivity and profitability of Jordanian banks as many banks were able to maintain a high leverage ratio by accumulating profits over time. Figure 3.8, shows the changes in interest margin to gross income during the period from 2003 to 2015. The interest margin to gross income ratio measures the contribution to net profit from interest in the bank's total income and reflects the contribution of the primary banks' functions in banks’ profit.

Figure 3. 8 Interest margin to gross income (2003-2015).



Despite the volatile nature of the ratio during the period 2003-2015, it was remained between 63.7 percent and 77.4 percent, which means that more than two-thirds of income generated by Jordanian banks come from interest bearing assets. Notice from Figure 3.8 how the ratio began a sharp decline in 2004 and 2005 before reaching the high point of 58.30 percent. This was as a result to the political problems in the region, referred to at the time as the Arab Spring, which caused bank customers to walk away without servicing their loans and interest, thereby forcing banks to focus more on the non-interest sources of income such as off-balance sheet activities. In 2011, the ratio declined to 70.10 percent as a result of the CBJ decision to reduce the interest rate and so commenced an upward trend in 2012, reaching 77.40 percent in 2015.

Figure 3.9 shows the return on equity (ROE) which was increased significantly from 9.9 percent in 2003 to 20.9 percent in 2005 due to improvements in bank profitability. But gradually declined to 8.3 percent in 2011 then start increasing onwards as a result of favorable economic conditions which helped to enhance the profitability of the banking sector, but then it declined in 2015 due to unfavorable banking situations.

Figure 3. 9 Rate of Return on Equity (2003-2015).

Regarding the return on assets (ROA), Figure 3.10 shows that the ratio has been a little unstable, reaching 2 percent in 2005 before commencing a steady decline through to (1.10%) in 2009 as a result of the impact of the global financial crisis. This decline may be attributed not only to the increase of income tax rate on banks but also to the conservative approach to bank lending followed by the banking sector.

Figure 3. 10 Rate of return on assets (2003-2015).

Figure 3.11 shows the liquidity ratio which measures a banks liquid assets' available to cover its obligations for the banking sector for the period 2003-2015. According to the bank finance literature, a high level of liquidity is an indication of the degree of soundness of the banking sector and its ability to fulfill its obligations. A sustained significant decline in the level of liquidity implies that a bank is faced with liquidity risk. For the period evidence by the data, Figure 3.11 shows that there was a significant change in the liquidity ratio. For example, in 2003 the ratio was 179.6 percent, but began to gradually decline as a result of the

impact of the global financial crises before increasing in the mid-2008-2009 as a result of measures adopted by the banks to redirect their investments towards liquid assets at the expense of credit facilities.

Figure 3. 11 Liquidity ratio (2003-2015).

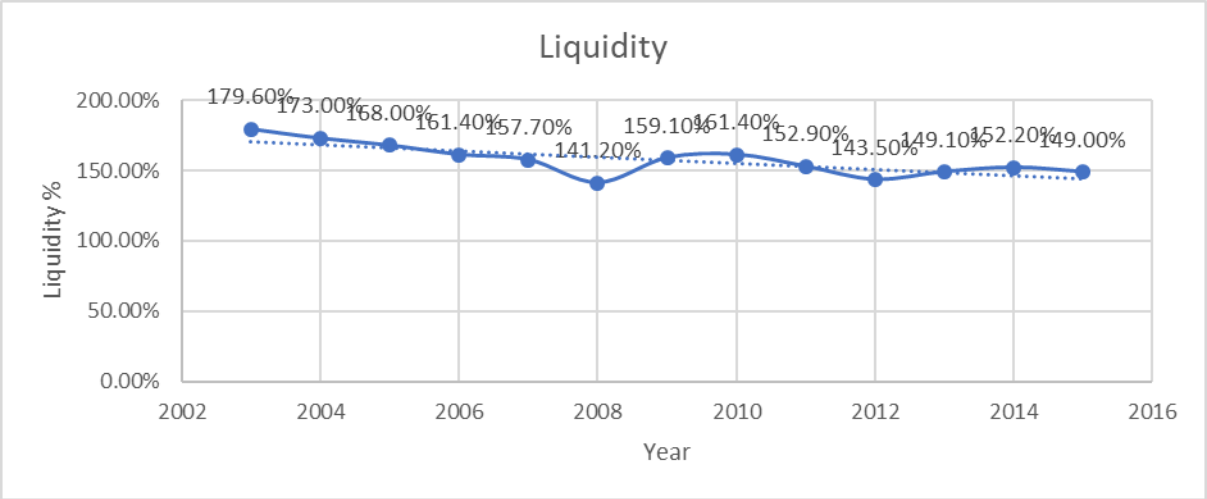


Table 3 3 Financial soundness indicators for the Jordanian banking sector 2003-2015.

Year	Capital Adequacy Ratio	Leverage Ratio	Return on Equity	Return on Assets	Interest Margin to Gross Income	Coverage Ratio	Debt ratio of (non-performing)	Liquidity	Growth Rate of Customer Deposits	Growth Rate of Credit Facilities
2003	15.9%	7.5%	9.9%	.7%0	63.7%	51.9%	15.5%	179.6%	6.4%	2.7%
2004	17.8%	8.9%	13.1%	1.1%	58.3%	63.8%	10.5%	173.0%	15.9%	19.3%
2005	17.6%	10.5%	20.9%	2.0%	56.4%	78.4%	6.6%	168.0%	13.4%	25.9%
2006	21.4%	13.2%	15.0%	1.7%	70.2%	80.0%	4.3%	161.4%	11.4%	27.2%
2007	20.8%	13.3%	12.6%	1.6%	66.7%	67.8%	4.1%	157.7%	9.6%	16.1%
2008	18.4%	12.9%	11.5%	1.4%	71.3%	63.4%	4.2%	141.2%	13.2%	17.2%
2009	19.6%	13.0%	8.8%	1.1%	71.6%	52.0%	6.7%	159.1%	12.1%	2.1%
2010	20.3%	13.1%	8.8%	1.1%	74.3%	52.4%	8.2%	161.4%	10.9%	8.6%
2011	19.3%	13.1%	8.3%	1.1%	70.1%	52.3%	8.5%	152.9%	8.3%	9.8%
2012	19.0%	13.3%	8.6%	1.1%	76.6%	69.4%	7.7%	143.5%	2.4%	12.5%
2013	18.4%	12.9%	9.9%	1.2%	77.6%	77.0%	6.8%	149.1%	10.5%	6.3%
2014	18.4%	12.5%	11.1%	1.4%	77.9%	79.7%	5.6%	152.2%	9.3%	5.2%
2015	19.1%	12.7%	10.3	1.3%	77.4%	74.7%	4.9%	149%	7.7%	9.6%

Source: CBJ Database (2003-2015).

3.4 Summary and Conclusion

This chapter discussed developments in the Jordanian banking since the 1990s including the CBJ regulations and its response to the various Basel accords and also provided an overview of measures of bank profitability and indicators of soundness for the banking sector. Analysis of the ratios suggests that the performance of the banking sector was affected by the impact of the global financial crisis and that the recovery of the sector was due to the policy measures adopted by the CBJ to help mitigate the financial distress experienced by banks which restored confidence in the banking system.

The following chapters presents an empirical analysis that includes some of the previously discussed financial indicators using a sample of 13 Jordanian banks for the period 2003-2015 in the light of the CBJ program of reform. To commence, I first investigate the impact of bank-specific, market structure, and macroeconomic variables on different profitability measures. Second, I then investigate empirically the impact of competition, risk and the interest rate environment on the profitability and risk-taking behavior of Jordanian commercial banks. Third, I examine the relationship between bank efficiency, capital, and risk of Jordanian commercial banks, and fourth I conclude the investigation by investigating how competition and efficiency of the banking sector influence the cost of credit for borrowing firms using data from 118 firms in addition to liquidity funding and Jordanian bank risk-taking behavior. Fifth, I examine the relationship between liquidity funding and risk-taking behavior of Jordanian Commercial Banks in addition to the impact of the implementation of the deposit insurance scheme from 2000 on Jordanian bank capital and liquidity creation.

CHAPTER 4

Assessing the Effects of Competition, Risk, and Market Interest Rate on Bank Profitability: An Empirical Analysis of the Jordanian Banking Sector

4.1 Introduction

In any economy, the banks' intermediation role is to channel funds from surplus units to deficit units to enable growth and development. In this respect, several studies, such as (Asli Demirguc-Kunt, Laeven and Levine, 2005) and (Gromb and Vayanos, 2010) report evidence which supports a positive relationship between the level of financial development and economic growth. In addition, globalization and liberalization of financial services is also considered to play a significant role to improving the banking industry and can take several forms – one of which is creating a competitive market via increasing the number of banking and non-banking financial institutions. Competition in the banking sector levies serious effects on bank performance indicators such as risk and profitability. Some researchers believe that increases in competition and financial innovation contribute generally to financial disruptions, while others such as (Anginer et al., 2012) link financial crises to highly concentrated markets and government support of the largest banks which mitigate access to finance by medium and small-sized banks. Therefore, analysing how competition might have shaped the performance and risk indicators of the Jordanian banking sector will be of interest to bank managers and policy makers, especially since there is shortage of published empirical research that has examined the competitiveness of the Jordanian banking sector and, more specifically, the evolution of competition over the reform periods since 1990.

Studies on bank profitability and its relationship with the business cycle received renewed attention following the period of recession that followed the recent global financial crisis. Bank profitability is a predominant indicator of a sound and stable banking sector, but studies investigating the effect of operating in a low-interest-rate environment on profitability indicators are rare, especially in developing countries. In regard to this, the purpose of this chapter is to fill the gap in the literature by firstly, assessing the degree of competition in the Jordanian banking sector and the extent to which market competitiveness has changed following the entry of six new banks in the market or not using the non-structural approach of

the Panzar-Rosse model for the period 2003-2017 and, secondly, to empirically assess the impact of competition, interest rate and liquidity risk on bank profitability and risk-taking behavior for a sample of 13 commercial Jordanian banks for the period 2003-2015 using the Fixed Effects (FE), Random Effects (RE), Generalized Least Square (GLS), and Generalized Method of Moments (GMM) methods. According to (Bikker and Haff, 2002), banking markets can, in general, operate under conditions of either perfectly competitive, monopolistic, or monopolistic competitive behavior. In the Jordanian context, the banking sector may be considered highly concentrated and operates under the condition of monopolistic competition (Hamiltona et al., 2010; Al-jarrah, 2010). Therefore, understanding the market condition under which Jordanian banks compete is crucial if bank managers, policy makers, and investors, are to have a clear understanding of how competition, risk, the level of interest rate, and bank profitability interact together. Interest on loans is the main source of income for Jordanian banks amounting to 77.4 percent of total income in 2015 and thus it is of interest to know how changes in interest rate affect bank profitability. Several internal and external factors have also influenced the banking system's profitability and performance such as individual bank characteristics, market factors, and macroeconomic indicators. The study examined the local commercial banks as it covers around 90% of the Jordanian banking system. We excluded the foreign bank as they are not listed in the Amman Stock Exchange and for the difficulties to gather the needed data. This chapter is divided into six sections: Section 4.2 presents an overview of the literature. Section 4.3 presents the data and methodology. Section 4.4 presents empirical results, and finally, section 4.5 outlines the summary and conclusion.

4.2 Literature review

This section is divided into three parts covering literature on the profitability-investigated indicators, competitiveness, risk, and interest rate. Most of the related literature apply data from developed countries while empirical evidence from the Middle East region especially Jordan is rare.

4.2.1 Literature review on bank competitive conditions

The literature on bank competitiveness generally applies the Panzar-Rosse H statistic (Rosse and Panzar, 1977; Panzar and Rosse, 1982 and 1987) to investigate the level of bank

competition. This approach has been used by scholars such as (Shaffer, 1983), (Nathan and Neave, 1989), (Molyneux et al., 1996), (De Bandt, 2000), (Hempell, 2005), (Coccorese, 2004), and (Casu and Girardone, 2009). (Shaffer, 1983), for example, examined the competitive position of banks in New York by applying the Panzar-Rosse method and report that banks behaved neither as monopolists nor as perfectly competitive entities in long-run equilibrium. (Nathan and Neave, 1989) using Canadian data assessed the state of competition using cross-sectional data covering 1982, 1983 and 1984 and report that banking revenues behave as if earned under monopolistic competition. Banking systems in regions such as U.S., Canada, the European Union (EU), India, China, Latin American and Japan, are found by (Yuan, 2006), (Matthews et al., 2007), (Prasad and Ghosh, 2007), to operate under monopolistic competition conditions. Semih (Yildirim and Philippatos, 2007) using firm level data for a sample of 14 Central and Eastern European (CEE) transition economies analyzed the evolution of competitive conditions in the banking industries for the period 1993-2000 and report findings which suggested that banking markets cannot be characterized as either perfect competition or monopoly, except for the banking sectors of Macedonia and Slovakia. Other studies such as (Duncan and Langrin, 2002), (Duncan and Langrin, 2004), (Mlambo and Ncube, 2011), (Anzoategui et al., 2012), (Simpasa, 2013) and (Ye, 2013), examine the evolution of competition in developing regions such as South Africa, Jamaica, Zimbabwe, China, the Middle East, and Turkey. For example, (Anzoategui et al., 2012) using the (Panzar and Rosse, 1987) approach studied the Tunisian banking sector and report that banks in Tunisia earned their revenue in a monopolistic competitive environment. Le (2014) using an unbalanced panel data of 33 commercial banks also applied the Panzar–Rosse approach and found that Vietnamese commercial banks operate under monopolistic market conditions. Similarly (Simatele, 2015) using South African data and the Panzar-Rosse approach examine the relationship between bank structure, performance and competition. He estimated a revenue equation to obtain the H statistic and found that competition increased over time and that South African banks operate in a monopolistic competitive market structure. On the other hand, (Suzuki, 2015) used different concentration ratios and the Panzar-Rosse method for measuring competition to assess the market structure of the banking sector of Bangladesh and report a reduction in concentration and an increase in competition in the banking sector. The results show that the level of competition was higher in the interest-based regular banking market than in the fee-based non-banking market and that banks in general faced more competition in the credit market than they did in the deposit market.

(Zarein et al., 2015) applied data for the Iranian banking sector and applied the H-statistic to investigate the competitive condition for the period 2005-2010. To calculate H statistics, a reduced form of revenue equation was estimated. The results indicate that the Iranian banking sector operate under conditions of monopolistic competition. (Vardar, 2015), using Turkish bank data for the period 2002-2012 looked at the impact of bank competition on the risk-taking behavior of Turkish banks. And after estimating the H-statistic as a measure of competition, report that competition in Turkey has a negative impact on the financial fragility of Turkish banks, indicating that banks in a more competitive market tend to take lower levels of risk. (Al-Muharrami et al., 2006) using the Panzar-Rosse 'H-statistic' for the period covering 1993-2002 examine the monopolistic power of banks of Gulf Cooperation Council **(**GCC) countries and report that while Kuwait, Saudi Arabia, and UAE banks have moderately concentrated markets, they are moving to less concentrated positions, even though they operate under conditions of monopolistic competition. They also report that Qatar, Bahrain, and Oman are highly concentrated banking markets, while Omani banks operate under monopolistic competition.

4.2.2 Literature review of the impact of risk on bank profitability

Liquidity risk adversely affects overall bank earnings/profit and capital/reserve. A liquidity trap can occur anytime savers begin to withdraw their deposits, during such times banks are left with two options either to borrow money from the central bank or engage in inter-bank transactions at high prices. Those banks that maintain sufficient deposits in their account balances can mitigate the incurred potential losses during these times. The negative side of liquidity risk is that it can be high enough so as to cause a bank run (Kashyap et al., 2002). In regard to this, (Shen et al. 2009) used a unbalanced panel dataset of commercial banks in 12 advanced economies (Canada, Australia, Germany, France, Taiwan, Italy, Luxembourg, Netherlands, Japan, Switzerland, U.K, and the U.S.A) for the period 1994-2006 by employing alternative liquidity risk measures, besides liquidity ratio and looked at the causes of liquidity risk. They found that liquidity risk may lower bank profitability (return on average assets and return on average equities) due to the higher cost of funds, while also increasing banks' net interest margins. Furthermore, they classified countries as either bank-based or market-based financial systems and revealed that liquidity risk is negatively related to bank performance especially in the market-based financial systems. (Akhtar et al., 2011) using the FE method

investigated the significance of variables with liquidity risk management for both conventional and Islamic banks operating in Pakistan and studied the impact of capital adequacy, size, networking capital, ROA and ROE, on the liquidity risk management for the period 2006-2009. They found no significant evidence of a relationship between size and networking capital to net assets with liquidity risks and that the capital adequacy ratio in conventional banks and return on assets in Islamic banks significantly influenced liquidity risk. (Arif and Nauman Anees, 2012) also examined the effect of liquidity risk on banks' profitability in Pakistan covering the period 2004-2009 by applying multiple regression to assess the impact of liquidity risk on banks' profitability and report a significant positive effect of liquidity risk on bank profitability and some evidence of a negative relationships between liquidity gap and non-performing loans on profitability.

4.2.3 Literature review on the impact of market interest rate on bank profitability

There is a growing literature on the impact of market interest rate on bank profitability. In the province of this literature, (Bourke, 1989) explored profitability determinants based on the financial statements of 90 banks for 12 developed countries or states using annual data for the period 1972-1982. Using a set of control variables (capital ratio, liquidity, staff expenses, concentration, government ownership, interest rate, market growth and inflation) in addition to return on capital, return on assets, and value-added as dependent variables, the findings indicate that capital ratios, liquidity ratios and interest rates were all positively correlated with profitability while government ownership and staff expenses had an inverse relationship with profitability. The author also reports the presence of weak correlation in the relationship between pre-tax return on assets and profitability, while concentration is moderately and positively correlated with pre-tax return on assets and negatively correlated with the value-added. (Albertazzi and Gambacorta, 2009) using the GMM estimator suggested by (Arellano and Bond, 1991) combined with data for 10 industrialized countries covering 1981-2003 looked at the effects of both macroeconomic and financial shocks on banking profitability by studying the link between business cycle fluctuations and banking sector profitability and report the dispersion of bank profitability among euro-area countries has declining dramatically since the mid-1990s. It was found that GDP influences both net interest income and loan loss provisions (via lending activity and credit portfolio quality respectively) and that the higher

level of bank profitability in the U.K and U.S.A were at least partly related to their more flexible cost structure. The authors also note that pro-cyclicality was slightly greater in the U.K. and in the U.S. and that the net interest income of banks was less affected by fluctuations in long-term interest rate but more affected by money market interest rate in countries such as Italy, Spain, and Portugal where banks have more short-term assets. It was found that net interest income of German banks was not significantly affected by changes in interest rates and that net interest income positively affected the profitability of banks conventional financial activities. While the ratio of total loans to GDP was found to be positively correlated with net interest income and further that stock market capitalization relative to GDP had a strong and significant effect on net interest income.

(Dietrich and Wanzenried, 2011) analyzed the profitability of commercial banks in Switzerland from 1999-2006 using data for 453 banks and found a positive relationship between capitalization and bank loans with profitability, especially when bank's loan volume is growing at a much faster rate than the market, and that bank age had no impact on profitability. On the question of bank ownership, they note that foreign banks were less profitable than Swiss-owned banks while privately owned banks were found to be more profitable than state-owned banks and that banks reliant on interest rate yield were likely to be less profitable. In addition, the authors report that the variables total loan growth, funding costs, operational efficiency, affect bank profitability positively and that the 2008 financial crisis had a significant impact on the profitability and productivity of the Swiss banking industry. On a similar issue, (Genay and Podjasek, 2014) found that the low-interest-rate environment is associated with decreased profitability for banks, particularly for small institutions in a sample of US banks from 2003-2013. Similar findings were postulated by (Bikker and Vervliet, 2018) for all U.S. commercial and savings banks covering the period 2001-2015. Regarding the effects of the low-interest rate environment on bank risk-taking behavior, the authors found no conclusive evidence to suggest that banks increase their risk exposure to search for new income sources. However, it was found that banks operating in a low-interest environment had significantly lowered their level of credit loss provision.

4.2.4 Literature review on bank profitability indicators

Much has been written on bank profitability indicators of which the work of (Molyneux and Thornton, 1992) is an example. Using annual data for a sample of 18 European banks

covering the period 1986-1989, (Molyneux and Thornton, 1992) estimated a simple linear equation (using government ownership, concentration, long-term bond rate, money supply, capital and reserves, cash and bank deposits, consumer price index, and staff expenses as independent variables and net profit after and before tax is used as dependent variables) and report that staff expenses are positively correlated with ROA and that government ownership and the level of interest rates had a significant positive association with ROE, which contradicts the earlier findings of (Bourke, 1989). They also note that due to associated costs with liquidity holdings, that liquidity had a weak inverse relationship with profitability and that concentration had somewhat of a positive, statistically significant correlation with pre-tax return on assets consistent with the findings of (Bourke, 1989). (Demirgüç-Kunt and Huizinga, 1999) also examined the determinants of commercial bank profitability using data for a sample of 80 banks drawn from developed and developing countries and found that well-capitalized banks faced lower cost of funding due to the lower probability of bankruptcy costs and the fact that these banks have much less need to borrow for assets acquisition. Their results also confirm a positive association between capital ratio and profitability and that loans to total assets have a negative influence on profitability, while short-term funding had a negative and significant impact on profitability. The relationship between profitability and non-interest earning assets was found to be negative as banks with high non-interest earning assets were found to be less profitable. The authors further point out that banks that use deposits as the main source of funding are less profitable because of the nature of deposits which required high branching and other expenses and that in developing countries foreign banks were more profitable than domestic banks.

(Graham, 2013), using data for a sample of 55 U.S. banks and 10 Canadian banks for the period 1997-2009 to assess the impact of liquidity on bank profitability found that profitability is improved for banks holding a higher proportion of liquid assets. The author notes that these assets also added to reducing banks' liquidity risk and that the results show that the relationship between liquid assets and profitability depend on the banks' business model. In addition, ((Staikouras and Wood, 2011) using the method of OLS and fixed effect models, examined both internal and external factors concerning the profitability of European banking system's (covering domestic and foreign institutions: commercial banks, cooperative banks, savings banks, and mortgage banks). The authors split their sample into two parts – large and small banks – and report that European banks' profitability is primarily influenced by factors related to management decisions and to the changes in the external macroeconomic

environment. They also report that loans to assets ratio are inversely related to banks' return on assets and the proportion of loan loss provisions to total loans and the variability of interest rates and the growth of GDP are negatively related to banks' return on assets.

With regard to the literature on developing and emerging banking markets, (Owusu-Antwi et al. 2014) investigated the determinants of banks 'profitability in Ghana using the GMM method to evaluate the determinants of profitability and report that economic value added is better than ROA as a measure of bank performance and that inflation does not affect the performance of banks in Ghana. (Said, 2014) examined the profitability of Malaysian banks' profitability using random and fixed effects methods and found a positive relationship between net stable funding ratio and banks performance indicators (ROE, ROA, and NIM). The author also found a positive impact of equity and size on the banks profitability and a negative relationship between cost to income ratio and bank profitability. (Fu et al., 2014) investigated the influence of bank competition, concentration, regulation, and national institutions on individual banks' fragility using GMM method and found that greater concentration and stronger deposit insurance schemes foster financial fragility.

Considering reform measures implemented by the central bank of Jordan over recent years, it is likely that competition within the banking sector of Jordan will have a positive effect on bank performance indicators such as profitability. For as the literature suggest bank profitability and its relationship with the business cycle have received considerable attention following the global financial crisis and the economic recession that resulted. It is widely acknowledged that bank profitability is a predominant indicator of a sound and stable banking sector. However, assessing the competitiveness of the Jordanian banking sector by applying Panzar-Rosse model is only one objective of this chapter. The second objective is to empirically assess the impact of liquidity risk and other factors on the profitability of Jordanian banks. While the third objective is to investigate the effect of operating in a low-interest-rate environment, utilizing profitability indicators, on Jordanian bank performance and in these respects the study makes a direct contribution to the existing literature.

4.2.5 Research Questions

In this chapter, I investigate whether or not the deregulation and liberalization program has affected the performance of Jordan's banking sector. Our expectation is that the new regulations should enhance the profitability measures of Jordanian banks. And we empirically

investigate how competition, risk, and interest rates affect Jordanian banks' profitability by addressing the following questions:

1. Do competitive conditions affect the profitability of Jordanian banks?
2. Does liquidity risk affect the profitability of Jordanian banks?
3. Do interest rates affect the profitability of the Jordanian banks?
4. Which market type monopoly, monopolistic competition or perfect competition, best represents the Jordanian banking sector?

4.3Data and Methodology

4.3.1 Data

This section assesses the degree of competition in the Jordanian banking sector by examining whether market competitiveness changed or not following the entry of six new banks in the market using the non-structural approach of Panzar-Rosse for the period 2003-2017. I also empirically assess the impact of competition, liquidity risk, interest rate on bank profitability and risk-taking behavior using a sample of 13 commercial Jordanian banks for the period 2003-2015. The study applies data from different sources: bank statements, the CBJ, the ABJ, annual reports of the ASE, data stream, and Bloomberg. Variables definitions and notations appear in Tables 4.1-4.3.

Table 4. 1Variables considered in assessing the impact of competition on the Jordanian banks' profitability (2003-2015).

Variable	Notation	Measurement	Type	Source
Dependent Variables				
Revenue (CF)	CF	Banks revenues from commotion and fees.	Bank-specific	Annual Reports
Profitability	ROA	Net income/Total assets	Bank-specific	Annual Reports
Independent variables				
Unit Price of Labor	PL	Ratio of personnel expenses to Total Assets.	Bank-specific	Annual Reports
Unit Price of Capital	PK	ratio of capital expenses to fixed assets	Bank-specific	Annual Reports
Unit Price of Funds	PF	ratio of annual interest expenses to total loanable funds	Bank-specific	Annual Reports
Number of Branch	BR	Ratio of number of branches of a bank to the total number of branches.	Bank-specific	Annual Reports
Bank size	SIZE	Natural logarithm of total assets	Bank-specific	Annual Reports

Risk	RISKASS	Ratio of provisions of loan loss to total assets.	Bank-specific	Annual Reports
Competition	Lerner index	the difference between price and marginal cost, divided by the price	Market structure	CBJ
Insurance Premium	INStoGDP	Insurance premium to GDP.	Macro	Annual Reports
Inflation rate	INF	Annual Inflation Rate	Macro	CBJ
Independent variables				
Bank size	SIZE	Natural logarithm of total assets	Bank-specific	Annual Reports
Bank risk	LLPTL	Ratio of provisions of loan loss to total assets.	Bank-specific	Annual Reports
Liquidity	LIQUIDITY	Loans/assets	Bank-specific	Annual Reports
Capitalization	CAP	Total Shareholder's equity/total assets	Bank-specific	Annual Reports
Diversification	DIV	Non-interest income/gross revenue	Bank-specific	Annual Reports
Labor productivity	LP	Gross revenue/total number of employees	Bank-specific	Annual Reports
Taxation	TAXATION	Tax/operating profit before tax	Bank-specific	Annual Reports
Competition	Lerner	Estimated from the cost function	Bank-specific	CBJ
Concentration	C3	Total assets of largest three banks/total assets of the whole banking industry	Bank-specific	CBJ
Stock market development	SMD	Market capitalization of listed companies/GDP	Industry	CBJ
Inflation Rate	INF	Annual inflation rate	Macro	CBJ
GDP growth rate	GDP	Annual GDP growth rate	Macro	CBJ

Source: ASE, CBJ, ABJ

Table 4. 2Variables considered in assessing the impact of liquidity risk on Jordanian banks profitability (2003-2015).

Variable	Notation	Measurement	Type	Source
Dependent Variables				
Profitability	ROA	Net income/Total assets	Bank-specific	Annual Reports
Profitability	ROE	Net Income/Shareholder's Equity	Bank-specific	Annual Reports
Tobin's Q ratio	Tobin	Market value / Total Asset value	Bank-specific	Bloomberg
Economic Value Added	EVA	NOPAT − [WACC · Capital Investment]	Bank-specific	Bloomberg
Independent variables				
Bank size	SIZE	Natural logarithm of total assets	Bank-specific	Annual Reports
Capital Adequacy ratio-TIER 1	TIER1	TIER 1 Capital Ratio	Bank-specific	Data Stram
Liquidity Risk	LTD	Total Loans / Total Deposits	Bank-specific	Annual Reports
Capitalization	ETA	Total Equity /Total Assets	Bank-specific	Annual Reports

Net interest margin ratio	NIM	Net Interest Income/ Total Assets	Bank-specific	Annual Reports
Cost to income ratio	CTI	Total Expenses/ Total Income	Bank-specific	Annual Reports
Cost of fund ratio	COF	Total Interest Expenses/ Total Deposits	Bank-specific	Annual Reports
Concentration	CO3	Total Assets of Largest 3 Commercial Banks/Total Assets of the whole Commercial Banks Listed in ASE	Market Structure	Annual Reports
GDP Growth rate	GDP	Annual GDP Growth Rate	Macro	CBJ
Inflation rate	INF	Annual Inflation Rate	Macro	CBJ

Source: ASE, CBJ, Data-Stream.

Table 4. 3Variables considered in assessing the impact of interest rate on Jordanian banks profitability and risk taking (2003-2015).

Variable	Notation	Measurement	Type	Source
Dependent Variables				
Net Interest Margin	NIM	Difference between interest income and interest expense divided by total assets	Bank-specific	Annual Reports
Profitability	ROA	Net income/Total assets	Bank-specific	Annual Reports
Profitability	ROE	Net Income/Shareholder's Equity	Bank-specific	Annual Reports
Total Profit	Profit	Undivided profits and capital reserves	Bank-specific	Annual Reports
Profit Margin	PM	Profit before tax/ Total Assets	Bank-specific	Annual Reports
Total Capital Ratio	TCR	Total Risk-based Capital to Risk-weighted Assets	Bank-specific	Annual Reports
Credit Risk	PCL	Provision for credit losses over total loans	Bank-specific	Annual Reports
Independent variables				
Bank size	SIZE	Natural Logarithm of total assets	Bank-specific	Annual Reports
Capitalization	CAP	Total equity capital over total assets	Bank-specific	Annual Reports
Diversification	DIV	Total non-interest income divided by total income	Bank-specific	Annual Reports
Lending	LEN	Total loans over total assets	Bank-specific	Annual Reports
GDP Growth Rate	GDP	Annual GDP Growth Rate	Macro	CBJ
Inflation Rate	INF	Annual inflation Rate	Macro	CBJ
Short-term interest rate	SHTI	6-month money market rate	Macro	CBJ

Source: ASE, CBJ, Data-Stream.

4.3.2 Competition model

The selection of the variables in the different analysis is motivated by a large number of studies such as (Zarein et al., 2015), (Vardar, 2015), (Babic et al., 2015), (Matthews et al., 2007), (Casu and Girardone, 2011), and (Al-Muharrami et al., 2006). I measure bank profitability (dependent

variable) in the competition models using four indicators: return on assets (ROA). Revenue (CF) measures the revenues that come from the bank's commotion and fees. ROA provides information about the management's performance in using the banks' assets to generate income (Naceur, 2003). This ratio is broadly used to compare the financial performance of banks because it shows profit per unit of bank assets and acts as a proxy of the overall profitability of banking operations (Berger and Mester, 1997). Large ROA indicate high profitability.

The analysis undertaken accounts for bank-specific, industry-specific, and macroeconomic indicators that could affect the profitability of Jordanian banks. For this purpose, price of labor (ratio of personnel expenses to total assets) price of capital (ratio of capital expenses to fixed assets) price of funds (ratio of annual interest expenses to total loanable funds) branches (ratio of number of branches of a bank to the total number of branches) risk (ratio of provisions of loan loss to total assets), size (bank total assets) and insurance to GDP (insurance premium to GDP) are included in the model. The analysis is extended to test the impact of some of the previously listed control variables on ROE and ROA using the GMM method. These models incorporate other control variables such as liquidity (ratio of total loans over total assets) that reflect the ability of Jordanian banks to compensate for the decreases in banks' liabilities or the increase in the assets' side of the balance sheet (Goddard et al., 2013). There is no conclusive evidence reported in the literature on the profitability effect of liquidity, though (Molyneux and Thornton, 1992) have argued that high liquidity levels have the effect of dampen profitability, while others such as (Bourke, 1989) found that liquidity and profitability are positively correlated depending on the banks' risk management system.

In this study, the ratio of loan loss provision over total loans (LLPTL) is used to measure the risk level. Several empirical studies, comprising (Miller and Noulas, 1997), indicate that an increase in risk exposure decreases bank profitability. Capitalization (ratio of shareholders' equity over total assets) is used as a proxy for the efficiency of the financial institution. A positive impact of capitalization on bank profitability is expected for the following reasons. First, funding costs are lower for well-capitalized banks due to Jordanian banks having a relatively high level of creditworthiness. Second, well-capitalized Jordanian banks are more likely to engage in prudent lending which is more likely than not to fosters profit figures. Third, capital hedges potential losses of risky assets, and finally well-capitalized Jordanian banks are considered to have lower costs since they borrow less. On this point, (Berger, 1995) has argued that capitalization can have a negative impact on bank profitability because the higher the level

of capitalization that lower the relative risk position of the bank and according to the risk-return trade-off, lower risks lead to lower returns. This argument is supported by (Modigliani and Miller, 1963) and more recently by (Dietrich and Wanzenried, 2011). This variable enters the GMM model as one of the endogenous variables because of the reverse causation effect, since higher profits can translate into higher capital. Diversification (ratio of non-interest income over gross revenue) measures the diversity of bank activities. In this regard, (Tan and Floros, 2012) note that banks that engage in different activities are better positioned to be able to raise their profits and to reduce costs. A countercyclical effect can be observed between diversification and bank profitability as there is strong competition around fee-income services which contributes to reducing the individual banks' profit shares. Labour productivity (ratio of gross revenue over the total number of employees) acts as another proxy for banks' efficiency. I expect the labour productivity variable to have a positive impact on profitability. Taxation (ratio of tax over operating profit before tax) is used to reflect costs. This variable is used by (Tan and Floros, 2012) in their study of the Chinese banking industry. And they report a significant and negative impact of taxation on the profitability of Chinese banks which, they argued, can be explained by the fact that the high level of taxes increases costs and further leads to a reduction in bank profitability.

Regarding industry-related indicators, competition is measured using the Lerner index. Following (Tan, 2016), the structure–conduct–performance (SCP) hypothesis argues that less-competitive firms in a financial system tend to have a high Lerner index that feeds into large scales of operation and higher profits. However, the competition-efficiency hypothesis does argue that in a highly competitive environment, bank managers have more incentive to improve efficiency and reduce costs, thus enhancing profit shares. In this study, I also use of banking sector development (ratio of banking sector assets over GDP). Our expectation is that a higher developed banking sector is likely to foster the demand for banking services, which attracts more potential competitors to enter the banking market. The subsequent reduction in supply of banking services relative to the increased demand is expected to increase the prices of banking services and to further increase bank profitability.

Stock market development is measured as the ratio of the market capitalization of listed companies over GDP. Banks operating in countries with well-developed stock markets normally have higher profitability shares than their counterparts for the following reasons. Firstly, a highly developed stock market provides an alternative pool of funds for firms rather than conventional bank loans. Which, in turn, reduces the risks of loan default and fosters

profitability figures of the banks. Secondly, a developed stock market system also provides accurate information about listed firms and their investment portfolios which assists banks in the effective evaluation of the associated investment risks (Tan and Floros, 2012a).

GDP growth rate is a measure of total economic activity within an economy. A high economic growth encourages banks to lend more and permits them to charge higher margins. Some previous studies, such as (Pasiouras and Kosmidou, 2007) and (Kosmidou and Zopounidis, 2008) found a positive effect of economic growth on the profitability of banks while other studies such as (Tan and Floros, 2012) suggests that high economic growth improves the business environment and lowers bank entry barriers. The consequent increased competition can also dampen bank's profitability. Accordingly, we have no prior expectations about the profitability impact of GDP growth on Jordanian bank profitability. Similar ambiguity is also observed for the relationship between inflation and profitability, as it depends on whether inflation expectations are fully anticipated or not. Generally, high inflation rates are associated with high loan interest rates which lead to increased banks' profit as (Pasiouras and Kosmidou, 2007) notes. And as (Sami Ben Naceur and Omran, 2011) report, there is a negative relationship between inflation and bank profitability due to banks failing to fully anticipate inflation.

4.3.3 Liquidity risk model

We measure bank profitability in the liquidity risk models using four indicators – return on assets (ROA), return on equity (ROE), Tobin Q ratio (TOBIN Q) and Economic Value Added (EVA). Tobin's Q ratio is used as a profitability indicator in several studies (Demsetz and Lehn 1985, (Naushad and Malik, 2015) and (Morck et al., 1986). Tobin's Q is a measure of the organization's competence in the market (Morck et al., 1986). To represent the market performance of a firm, Tobin's Q is a standard measure of returns on investment as established by (Bond et al., 2004). EVA is the fourth financial profitability measure used in our analysis and reflects how much of the accounting profit is converted to economic profit. A positive EVA reflects the ability of the bank to increase the shareholder's wealth.

Analysis of the study incorporates a large number of control variables. Size is generally used to measure economies or diseconomies of scale in the banking industry. According to (Athanasoglou et al., 2008), the profitability effect of banks' size is inconclusive. A negative impact of bank size on bank profitability was found by (Sufian, 2009), who mentioned that small banks can earn higher profit more than larger bank because

small banks have better performance efficiency and incur lower expenses. However, (Karim and Alam, 2013) found that bank size has a significant positive impact on the financial profitability of Bangladeshi commercial banks. Capital Adequacy (Tier-1) captures the share of bank capital. Tier1 capital is an essential form of capital that includes equity capital and disclosed reserves. A large number of studies have investigated the link between capital adequacy and bank profitability in different countries such as the empirical study of (Perera et al., 2013) who found that adequate capital has a significant positive effect on banks' profitability. Similar results were found by (Kosmidou, 2008) and (Umoru and Osemwegie, 2016). The introduction of capital adequacy rules normally intensifies banks' capital and thereby improve the resilience of banks to negative shocks.

Loans to Deposit (LTD) variable is used as an exogenous instrument for liquidity risk and is considered to strongly influence banks' profitability (Rengasamy, 2014). This ratio indicates the percentage of banks' loans funded through deposits. The profitability effect of liquidity risk remains a contentious issue. Some studies report that liquidity risk has a negative impact on banks' profitability (Shen et al., 2009) although others (Bourke, 1989) found a positive significant link between bank liquidity and profitability. Equity to Assets (ETA) is used to proxy capital strength. (Pasiouras and Kosmidou, 2007) and (Dietrich and Wanzenried, 2011) note that in the event of loss or liquidation, banks with high capital-asset ratios are considered relatively safer. A higher equity to assets ratio of banks means lower needs to external funding and therefore higher profitability. The theory of capital structure states that higher use of debt (equity) financing within a certain range, called the target capital structure, might actually reduce (increase) firms‟ cost of capital. Thus, a positive (negative) coefficient estimate for equity-to-assets indicates an efficient (inefficient) management of banks‟ capital structure.

Net Interest Margin (NIM) reflects the volume of the traditional borrowing and lending operations of the bank. This rate measures the gap between what the bank pays for the depositors and what the bank receives from borrowers. The interest yield is one of the major income sources for banks. Profit is based on the positive difference between the interest on loans and interest on deposits. (Muriith, 2016) notes that fluctuations in net interest margin are one of the main important sources of uncertainty in bank profitability but (Hanweck and Ryu, 2011) points out that bank net interest margins are negatively related to interest-rate volatility but positively related to increases in the slope of the yield curve. The cost of Fund (COF) shows the management efficiency for the banks' funds. Only a few researchers have

studied the effect of the COF on bank profitability. High-cost of funds mean low-profit shares. (Zarein et al., 2015), (Dietrich & Wanzenried, 2011), and (Islam and Nishiyama, 2016) found that COF has a significantly negative impact on bank profitability. The Cost to Income (CTI) measures the overheads or expenses required to run a bank and also acts as a measure for the overall efficiency in managing banks' expenditures (Pasiouras and Kosmidou, 2007) and (Dietrich and Wanzenried, 2011). The lower the ratio, the more profitable the bank is. For example, (Said, 2014) found a negative relationship between cost to income ratio and bank profitability.

Concentration (CO3) is a measure of the competitiveness of the banking sector. According to the structure-conduct-performance (SCP) hypothesis, banks in highly concentrated markets tend to collude and earn more monopoly profits (Short, 1979, Gilbert, 1984 and Athanasoglou et al., 2008). Mixed findings of the relationship between concentration and bank performances are mentioned in the empirical studies. A positive impact of concentration on banking performance was suggested by (Staikouras and Wood, 2011b) while a negative relationship between concentration and bank profitability was reported by (García-Herrero et al., 2009). We also employ the GDP growth rate and Inflation as macroeconomic indicators. These variables were discussed in the previous section.

4.3.4 Interest rate model

The following dependent variables are used in the interest rate model – NIM, ROA, and ROE, profit (a measure for the undivided profit and capital reserves). The net effect on profits might be positive as a result of the low-interest rate environment which results in better economic outcomes that are proxied by profit margin (before-tax profits as a share of total assets that reveal the welfare consequences for banks and their customers). Total Capital Ratio (TCR) (ratio of total risk-based capital over risk-weighted Assets) (Genay and Podjasek, 2014). As banks engage in risky investments. They constantly search for sufficient yield, translating into a lower TCR ratio), and credit loss provisions to total loans ratio (PCL) (A measure for the level of credit risk and acts as a proxy for the provision for credit losses over total loans. It is hypothesized according to (Athanasoglou et al., 2008) that the negative impact of credit risk creates a higher level of provisioning on bank profitability).

The following variables are used as control variables – size, lending, capitalization, diversification, PCL and TCR, real GDP growth, Inflation and short-term interest rate. Most of these variables have been previously discussed. But other indicators include short-term

interest rate which is represented by the 6-month money market rate. In the literature, the short-term interest rate has received much attention because nominal interest rate steering is the main instrument that central banks use to stimulate the economy. The effect of short-term interest rate and the slope of the yield curve for loan loss provisions are positive as founded by (Bolt, et. al, 2012) and (Borio and Zhu, 2012) who showed that short-term interest rate negatively affects net interest income and that long-term interest rate positive affects net interest income. (Alessandri & Nelson, 2015) found that the net interest margin increases with short-term interest rate (since banks raise their lending rates and reduce their lending volume in response to higher interest rates). (William, 2002) argue that interest rate volatility negatively affects net interest margins. (Demirgüç-Kunt and Huizinga, 1999) found a positive effect of short-term interest rates on the net interest margin for smaller banks. However, (Delis and Koureatas, 2011) note that low-interest rate reduced the default probability on outstanding loans, and hence, reduces provisions for non-performing loans.

4.3.5 Descriptive statistics

Tables 4.4-4.6 show the variables' descriptive statistics. Regarding the competitiveness model in Table 4.4, The average value of the revenue (CF) is 2 percent, with a standard deviation of 3.5 percent. The ROA mean value is 2.3 percent, with a standard deviation of 0.69 percent. The average size is 9.1 percent with a standard deviation of 0.48 percent. The average RiskAss is 0.4 percent, with a standard deviation of 0.4 percent. The average PL is 1.07 percent with a standard deviation of 0.4 percent. The average PF is 3.0 percent with a standard deviation of 1.1 percent. The average PK is 1.8 percent with a standard deviation of 1.04 percent. The average BR is 7.4 percent with a standard deviation of 5.6 percent. The average INP to GDP is 1.1 percent with a standard deviation of 8.09 percent. LLPTL, size, CAP have mean values of 0.70, 9.14 and 14.21 percent and standard deviation values of 6.96, 0.49, and 6.35 percent respectively. Liquidity, taxation, diversification and LP have mean values of 43.83, 33.37, 16.06 and 4.93 percent, and standard deviation values of 10.5, 45.33, 6.40 and 0.284 percent respectively. Lerner's index and C3 have means of 0.37 and 68.81 percent, and standard deviations of 0.05 and 3.70 percent respectively. BSD, SMD, GDP and INF have means of 461.21, 8.51, 4.74 and 3.80 percent, and standard deviations of 35.23, 20.12, 2.47 and 3.37 percent respectively.

Table 4. 4Summary Statistics (Competition model).

VARIABLES	Obs	Mean	Std. Dev.	Min	Max
Revenue (CF)	195	2.0507	3.5107	.6980	1.7108
ROA	195	2.3818	.69246	-.01	5.97
Size	195	9.1763	.4898	7.8249	10.4126
RiskAss	195	.4068	.4762	-.9356	3.2434
PL	195	1.0790	.4394	.3994	4.4646
PF	195	3.0121	1.1379	.9787	7.7400
PK	195	1.8211	1.0426	.3989	6.5572
BR	195	7.4432	5.6989	.2890	27.7456
INPtoGDP	195	1.1610	8.0909	1.6909	2.5710
INF	195	3.8086	3.3784	-.7	14
LLPTL	166	.70046	6.9611	-83.9113	19.3130
Size	169	9.1438	.49730	7.8249	10.4126
Cap	169	14.210	6.3536	-31.3545	37.5247
Liquidity	169	43.8393	10.5195	.2785	60.2789
Taxation	169	33.3723	45.3375	-36.2378	401.9836
Diversification	169	16.0606	6.4081	5.8757	52.3875
LP	168	4.9373	.2847	3.3242	5.6586
LernerIndex	169	.3721	.0546	.22	.4365
C3	169	68.8130	3.7012	62.6021	76.0322
BSD	169	461.2179	35.2337	393.5676	512.5951
SMD	169	8.5143	20.1217	.2036	150.9594
GDP	169	4.7430	2.4796	2.3	8.53

Note: statistics calculated using STATA 5.1.

The statistics of the variables in the liquidity risk model are reported in Table 4.5. The profitability rates ROA, ROE, Q, and EVA have means of 1.43, 10.52, 1.07 and 1.70 percent respectively with standard deviations of 0.71, 5.55, 0.11 and 3.20 percent respectively. The means of the bank size ratio is 9.14 percent with standard deviation approaching .49 percent. Capital adequacy is, on average, 17.91 percent with a standard variation of 5.19 percent. Liquidity risk is, on average, 60.04 percent with a standard variation of 17.44 percent. Equity to assets is, on average, 13.20 percent with a standard variation of 4.65 percent. The mean of the net interest margin is 2.93 percent with a standard deviation of 0.70 percent. The mean of the cost of the fund is 3.09 percent with a standard deviation of 1.16 percent. The mean of the cost to income ratio is 56.77 percent with a standard deviation of 19.28 percent. The mean

of concentration is 68.81 percent with a standard variation of 3.70 percent. GDP and inflation rates have average values of 4.74 percent and 4.14 percent respectively with a standard deviation of 2.47 percent and 3.44 percent.

Table 4. 5Summary Statistic (Liquidity Risk Model).

VARIABLES	Obs	Mean	Std. Dev.	Min	Max
ROA	169	1.4343	.7122	-1.01	4.97
ROE	169	10.5227	5.5591	-2.24	39.84
Q	167	1.0799	.1193	.9407	1.5085
EVA	168	1.7068	3.2055	-8.0411	15.7714
size	169	9.1438	.4973	7.8249	10.4126
TIER1	154	17.9116	5.1908	9.4	36.07
LTD	169	60.0479	17.4401	.4010	101.9485
ETA	169	13.2010	4.6502	-31.3545	21.9639
NIM	169	2.9356	.7025	1.2743	4.40077
COF	169	3.0906	1.1612	1.1323	7.7400
CTI	169	56.7750	19.2847	15.2895	193.2614
C3	169	68.8130	3.7012	62.6021	76.0322
GDP	169	4.7430	2.4796	2.3	8.53
INF	169	4.1469	3.4460	-.7	14

Note: statistics calculated using STATA 5.1.

Finally, Table 4.6 provides summary statistics for the variables used in the interest rate model. The profitability rates ROA, ROE, NIM, Profit, and Profit margin have means of 1.43, 10.52, 2.9, 2.15 and 1.9 percent respectively with standard deviations of 0.71, 5.55, 0.70, 5.4, and .95 percent respectively. The mean value of bank size ratio is 9.1 percent with the standard deviation approaching .49 percent. Capitalization is, on average, 13.20 percent with a standard variation of 4.65 percent. Diversification is, on average, 16.06 percent with a standard variation of 6.40 percent. Lending is, on average, 43.83 percent with a standard variation of 10.51 percent. The mean of the TCR is 18.03 percent with a standard deviation of 4.87 percent. The mean of the PCL is 1.28 percent with a standard deviation of 2.24 percent. The mean of the GDP is 5.05 percent with a standard deviation of 2.5 percent. The mean of the Inflation is 4.14 percent with a standard variation of 3.44 percent. Short-term interest rate has an average value 4.04 percent with a standard deviation of 1.69 percent.

Table 4. 6 Summary Statistic (Interest rate Model).

Variable	Obs	Mean	Std. Dev.	Min	Max
ROA	169	1.4343	0.7122	-1.01	4.97
ROE	169	10.5227	5.5591	-2.24	39.84
NIM	169	2.9356	0.7025	1.2743	4.4007
Profit	169	2.1508	5.4308	-7.2307	2.8209
Profit margin	169	1.9790	0.9525	-0.9693	6.0685
Size	169	9.1438	.4973	7.8249	10.4126
CAP	169	13.2010	4.6502	-31.3546	21.964
DIV	169	16.0606	6.4081	5.8757	52.3876
LEN	169	43.8393	10.5195	0.2785	60.279
TCR	141	18.0349	4.8713	9.6	36.71
PCL	153	1.2849	2.2437	-0.7266	19.313
GDP	169	5.0584	2.5113	2.3	8.53
INF	169	4.1469	3.4460	-0.7	14
Shortir	117	4.0497	1.6993	2.05	6.734
Shortir2	117	19.2636	15.3733	4.2025	45.34676

Note: statistics calculated using STATA 5.1.

4.3.6 Empirical models

4.3.6.1 Models of competition and bank profitability

Following (Shaffer, 1983) and (Nathan and Neave, 1989), we develop an empirical model to investigate the impact of competition on bank profitability. We employ (Rosse and Panzar, 1977) and (Panzar and Rosse, 1982, 1987) nonstructural approaches. Using bank-level data the Panzar–Rosse model uses H-statistic to measure the magnitude of the impact of input price fluctuations on banks' equilibrium revenues. The H-statistic measures the elasticity of total revenues with respect to factor input prices and is calculated from a reduced-form bank revenue equation following (Gutiérrez de Rozas, 2011). In this regard, there are three possible scenarios. First, under monopolistic conditions, the increase in input prices can be expected to raise marginal costs and reduce output and hence total revenues will decline. The second scenario shows that under monopolistic competitive market conditions, revenues will increase less proportionally than input prices because the demand for banking products is inelastic. Third, when banks operate in perfectly competitive markets, it is expected that their marginal costs and will increase proportionally to input prices. With regard to the H-statistic, the value varies and interpreted as follows: $H \leq 0$ indicates a situation of monopoly. H =1

indicates perfect competition; and 0 < H <1 indicates monopolistic competition.

We test whether the variables are in a state of long-run equilibrium which involves estimating parameter E, where E = 0 indicates equilibrium and E < 0 indicates disequilibrium. Following (Molyneux et al., 1996), the model is based on a number of assumptions – banks are treated as single-product firms. In which case Jordanian commercial banks can be considered to act as an intermediation channel between savings and loans. Since Jordanian banks are considered to operate as profit maximizing firms and therefore high input prices are not necessarily associated with high revenue-generating services. Following (Bikker and Haaf, 2002), the theoretical PR-model is written as the following reduced form revenue function, where c is a vector of *n* bank-specific variables and *w* is the factor price elasticity.

$$ln\,R = \alpha + \sum_{i=1}^{m} \beta ln w_i + \sum_{t=1}^{n} \delta_t \ln c_i \qquad (4.1)$$

$$H = \sum_{i=1}^{m} \beta_i \qquad (4.2)$$

Table 4. 7Interpreting the Rosse-Panzar H-statistic.

Competitive environment test	
H≤0	Monopoly equilibrium
	Perfect colluding oligopoly
	Conjectural variations short-rum oligopoly
0<H<1	Monopolistic competition free entry equilibrium
H=1	Perfect competition
	Natural monopoly in a perfectly contestable market
	Sales maximizing firms subject to breakeven constraints
Equilibrium test	
E<0	Disequilibrium
E=0	Equilibrium

Source: (Rosse and Panzar, 1977), (Panzar and Rosse, 1982, 1987), Shaffer (1982, 1983), (Nathan and Neave, 1989), Molyneux et al. (1994), Hondroyiannis et al. (1999), amongst others.

Pooled OLS and Generalized Least Square (GLS) methods are used to empirically test the Panzar-Rosse model while GLS is used empirically to estimate panel data with no serial correlation while relaxing the assumption related to heteroskedasticity (Maddala and Lahiri, 2006). We also take natural logarithms of all variables. According to (Matthews et al., 2007) and (Al-Muharrami et al., 2006), the test for equilibrium can be calculated using the same revenue function (CF) and return on assets ROA, as shown in the following equations:

$$InCF_{it} = \alpha_0 + \alpha_1 lnPF_{it\ it} + \alpha_2\, lnPL_{it} + \alpha_3 lnPK + \beta_1 lnRISKASS_{it} + \beta_2 lnSIZE_{it} + \beta_3 lnBR_{it} + \gamma_1 LnINSTOGDP_t + \gamma_2 LnINF_t + \varepsilon_{it} \quad (4.3)$$

$$InROA + 1_{it} = \hat{\alpha_0} + \hat{\alpha_1}\, lnPF_{it} + \hat{\alpha_2} lnPL_{it} + \hat{\alpha_3} lnPK_{it} + \hat{\beta_1} lnRISKASS_{it} + \hat{\beta_2} lnSIZE_{it} + \hat{\beta_3} lnBR_{it} + \hat{\gamma_1}\, LnINF_t + \varepsilon_{it} \quad (4.4)$$

Where CF is the revenue from commission and fees. The H statistic equals $\alpha_1 + \alpha_2 + \alpha_3$. The measure ROA is actually calculated 1+ROA to adjust for (small) negative values ROA. We define the equilibrium E-statistic as $\hat{\alpha_1} + \hat{\alpha_2} + \hat{\alpha_3}$. The estimation results appear in Tables 4.8- 4.12.

We check the robustness of our results by using the Generalized Method of Moments (GMM) difference and system estimators to estimate Models 4.5 and 4.6. The GMM estimator is used in the current study to account for unobserved heterogeneity, autocorrelation, profit persistence over time, and endogeneity of some right-hand side variables such as capitalization. The next section presents a detailed discussion of the GMM method. These models use ROA and ROE as dependent variables while controlling for bank-specific, industry-specific and macroeconomic characteristics. These models also incorporate lagged risk measures to test risk persistence over time.

Lerner index is used as a measure of bank competition in the Jordanian banking sector and represents the ability to which a particular bank has the power to set its price above marginal cost. The index value ranges from a maximum of 1 to a minimum of zero, in which 1 represents the largest market power and the lowest competition. Following (Tan, 2016), the index is calculated as the difference between a bank's price and marginal cost divided by the price. The predetermined variables in the models are instrumented using one-period lagged variables, while the endogenous variables are instrumented using two-periods lagged variables. The estimation results appear in Table 4.13.

$$ROA_{it} = c + \hat{\alpha_0}\, ROA_{it-1} + \hat{\alpha_1} SIZE_{it} + \hat{\alpha_2} LLPTL_{it} + \hat{\beta_1} CAP_{it} + \hat{\beta_2} LIQUIDITY_{it} + \hat{\beta_3} DIV_{it} + \hat{\gamma_1}\, TAXATION_{it} + \hat{\gamma_2} LP_{it} + \hat{\gamma_3} Lerner_{it} + \hat{\gamma_4} C3_{it} + \hat{\gamma_5} SMD_{it} + \hat{\gamma_5} GDP_{it} + \hat{\gamma_6} INF_{it} + \varepsilon_{it} \quad (4.5)$$

$$ROE_{it} = c + \hat{\alpha_0} ROE_{it-1} + \hat{\alpha_1} SIZE_{it} + \hat{\alpha_2} LLPTL_{it} + \hat{\beta_1} CAP_{it} + \hat{\beta_2} LIQUIDITY_{it} + \hat{\beta_3} DIV_{it} + \hat{\gamma_1} TAXATION_{it} + \hat{\gamma_2} LP_{it} + \hat{\gamma_3} Lerner_{it} + \hat{\gamma_4} C3_{it} + \hat{\gamma_5} SMD_{it} + \hat{\gamma_5} GDP_{it} + \hat{\gamma_6} INF_{it} + \varepsilon_{it} \quad (4.6)$$

4.3.6.2 Models of liquidity risk and bank profitability

We use pooled OLS, fixed effects, as well as random effects methods to estimate models 4.7-4.11. These models aim to investigate the relationship between risk measures and bank profitability using our sample of Jordanian banks. Hausman specification test is applied to each model to decide whether to use FE or RE models (Hausman, 1978). We start our analysis by pooling the panel data and estimating it using ordinary least squares (OLS) regression. This method ignores bank specific heterogeneities and could generate biased and inefficient results. To correct for this bias, we use both FE and RE approaches to account for the distinct nature of each bank and control for the unobserved heterogeneity that is constant over time and correlated with the dependent variables such as Jordan's geographical location and cultural norms. These methods capture the within-variation across banks and time-related shocks that affect all banks such as global financial crises (Bjorvatn and Farzanegan, 2013). The main difference between RE and FE is that RE estimates are produced using GLS method while assuming that the unobserved heterogeneity is uncorrelated with the regressors. (Gujarati, 2009) states the basic framework for the fixed effects as follows:

$$Y_{it} = \alpha_0 + \alpha_1 Bank_{it} + \alpha_2 Ind_{it} + \alpha_3 Mac_{it} + \nu_t \quad (4.7)$$

Where *i* refers to an individual bank, *t* refers to the year, y_{it} is the dependent variable, *a* is the intercept term, α is a vector of parameters to be estimated on the explanatory variables. The explanatory variables are classified into three categories. First, $Bank_{it}$ is the bank-specific factors, second, Ind_{it} is the banking industry determinants, and third, Mac_{it} is the macroeconomic determinants and ε_{it} is an error term. We use the performance indicators ROA, ROE, Tobin Q ratio and EVA as dependent variables and develop the estimation models following ((Staikouras and Wood, 2011) and (Said, 2014) as follows:

$$ROA_{it} = \alpha_0 + \alpha_1 SIZE_{it} + \alpha_2 TIER1_{it} + \alpha_3 LTD_{it} + \alpha_4 ETA_{it} + \alpha_5 NIM_{it} + \alpha_6 CTI_{it} + \alpha_7 COF_{it} + \alpha_8 CO3_{it} + \alpha_9 GDP_{it} + \alpha_{10} INF_{it} + \varepsilon_{it} \quad (4.8)$$

$$ROE_{it} = \alpha_0 + \alpha_1 SIZE_{it} + \alpha_2 TIER1_{it} + \alpha_3 LTD_{it} + \alpha_4 ETA_{it} + \alpha_5 NIM_{it} + \alpha_6 CTI_{it} + \alpha_7 COF_{it} + \alpha_8 CO3_{it} + \alpha_9 GDP_{it} + \alpha_{10} INF_{it} + \varepsilon_{it} \quad (4.9)$$

$$Tobin_{it} = \alpha_0 + \alpha_1 SIZE_{it} + \alpha_2 TIER1_{it} + \alpha_3 LTD_{it} + \alpha_4 ETA_{it} + \alpha_5 NIM_{it} + \alpha_6 CTI_{it} + \alpha_7 COF_{it} + \alpha_8 CO3_{it} + \alpha_9 GDP_{it} + \alpha_{10} INF_{it} + \varepsilon_{it} \quad (4.10)$$

$$EVA_{it} = \alpha_0 + \alpha_1 SIZE_{it} + \alpha_2 TIER1_{it} + \alpha_3 LTD_{it} + \alpha_4 ETA_{it} + \alpha_5 NIM_{it} + \alpha_6 CTI_{it} + \alpha_7 COF_{it} + \alpha_8 CO3_{it} + \alpha_9 GDP_{it} + \alpha_{10} INF_{it} + \varepsilon_{it} \quad (4.11)$$

The estimation results appear in Tables 4.14 and 4.15.

4.3.6.3 Models of interest rate, risk-taking, and bank profitability

In this part of our analysis we use Pooled OLS and GMM approaches to estimate Models 4.12-4.13. For our dynamic models we have three precarious issues that should be considered in the empirical estimation. First, some bank profitability and bank risk-taking determinants are potentially endogenous. In econometrics, endogeneity broadly refers to situations in which an explanatory variable is correlated with the error term. This either follows from omitted variables bias or from causality between the independent and dependent variable (García-Herrero et al., 2009). Second, it is assumed there are some fixed effects that is specific to each individual bank that impact the bank's profitability or risk-taking which are not captured in the model known as unobserved heterogeneity. Third, the dynamic structure of the models complicates the estimation. Thus, if the independent variable is correlated with the error term (e.g. short interest rate) in a regression model, then the estimate of the regression coefficient in an ordinary least squares (OLS) regression will be biased. In such cases, GMM or IV approaches are the appropriate techniques to solve the endogeneity problem.

The system GMM estimator is widely implemented in related empirical studies on bank profitability and bank risk-taking (and allows for consistent estimation when the explanatory variables (covariates) are correlated with the error terms and are generally used in regression analysis when there are endogenous variables). The system GMM estimator from (Arellano and Bover, 1995) and (Blundell and Bond, 1998) provides consistent and unbiased estimates

when dealing with endogenous and dynamic models. It uses lagged values of the dependent variable both in levels and in differences as instruments as well as lagged values of the other, potentially endogenous regressors. We report a set of diagnostic tests to check whether or not the data are consistent with the assumptions of the (Arellano and Bond, 1991) estimator. The Sargan test statistic examines the over-identification restrictions. It essentially tests whether the instruments are uncorrelated with the error terms in the estimated equation. The Sargan test statistics for all models appear with a p-value greater than 0.10. Hence, we are unable to reject the null hypothesis. The second test is the AR (2) Arellano and Bond test for autocorrelation. The null hypothesis is 'no autocorrelation' and relates to the differenced residuals. The p-values for AR (2) show that all models are free from autocorrelation at the 1 percent level.

In our models, we use the performance indicators NIM, ROA, ROE, Profit, Profit Margin, PCL, and TCR as dependent variables. Following (Bikker and Vervliet, 2018) we develop the following models to test the empirical effect of interest rate on the profitability and risk taking of Jordanian commercial bank. Model 4.14 uses bank profitability measures as the dependent variables and Model 4.15 uses bank risk-taking measures as dependent variables.

$$\Pi_{it} = c + \alpha\Pi_{i,t-1} + \beta X_{it}^{BS} + \gamma X_{it}^{Macro} + \delta X_{it}^{IR} + \varepsilon_{it} \quad (4.12)$$

$$r_{it} = c + \alpha r_{i,t-1} + \beta X_{it}^{BS} + \gamma X_{it}^{Macro} + \delta X_{it}^{IR} + \varepsilon_{it} \quad (4.13)$$

where *i* refers to an individual bank, *t* refers to the year, r_{it} is the risk measure variables for bank *i* in year *t*; the degree of risk persistence is captured by the coefficient α. The other regressors and the error term are similar to those in previous models. The empirical results appear in Tables 4.20 and 4.22.

$$NIM_{it} = \alpha_0 + \alpha_1 SIZE_{it} + \alpha_2 CAP_{it} + \alpha_3 DIV_{it} + \alpha_4 LEN_{it} + \alpha_5 GDP_{it} + \alpha_6 INF_{it} + \alpha_7 TCR_{it} + \alpha_8 PCL_{it} + \alpha_9 SHTI + \varepsilon_{it} \quad (4.14)$$

$$ROA_{it} = \alpha_0 + \alpha_1 SIZE_{it} + \alpha_2 CAP_{it} + \alpha_3 DIV_{it} + \alpha_4 LEN_{it} + \alpha_5 GDP_{it} + \alpha_6 INF_{it} + \alpha_7 TCR_{it} + \alpha_8 PCL_{it} + \alpha_9 SHTI + \varepsilon_{it} \quad (4.15)$$

$$ROE_{it} = \alpha_0 + \alpha_1 SIZE_{it} + \alpha_2 CAP_{it} + \alpha_3 DIV_{it} + \alpha_4 LEN_{it} + \alpha_5 GDP_{it} + \alpha_6 INF_{it} + \alpha_7 TCR_{it} + \alpha_8 PCL_{it} + \alpha_9 SHTI + \varepsilon_{it} \quad (4.16)$$

$$Profit_{it} = \alpha_0 + \alpha_1 SIZE_{it} + \alpha_2 CAP_{it} + \alpha_3 DIV_{it} + \alpha_4 LEN_{it} + \alpha_5 GDP_{it} + \alpha_6 INF_{it} + \alpha_7 TCR_{it} + \alpha_8 PCL_{it} + \alpha_9 SHTI + \varepsilon_{it} \quad (4.17)$$

$$PM_{it} = \alpha_0 + \alpha_1 SIZE_{\ it} + \alpha_2\, CAP_{it} + \alpha_3 DIV_{it} + \alpha_4 LEN_{it} + \alpha_5 GDP_{it} + \alpha_6 INF_{it} + \alpha_7 TCR_{it} + \alpha_8\, PCL_{it} + +\alpha_9 SHTI + \varepsilon_{it} \quad (4.18)$$

4.4. Empirical results

4.4.1 Competition results

This section discusses the estimates of models covering the following sub-periods (2003-2005, 2006-2008, 2009-2011, 2012-2014, and 2015-2017) as reported in Tables 4.8 to 4.12. The dependent variable of the Revenue (CF). The H-statistic values are equal to: 0.2662884 (2003-2005), -0.5767809 (2006-2008), 1.1344102 (2009-2011), .8893453 (2012-2014) and 0.2882701 (2015-2017). This study examines the competitive conditions in Jordan's banking industry for the period 2003-2017. This period corresponds to a period characterized by important reforms undertaken by CBJ and the government to liberalize the financial systems. The results suggest that Jordan's banking market cannot be described by either perfect competition or monopoly over 2003-2017. The results show the estimated parameters of the P-R model, Revenue (CF) model results indicate that Jordanian commercial banks operate under monopolistic competitive conditions. The Jordanian commercial banks' competitiveness has not changed except during the period 2009-2011, wherein the H-statistic has increased to 1.1344102. The positive change in the competitiveness state of the Jordanian banking sector corresponds to the entry of six new banks in 2004 and 2009 (Bank Audi, National Bank of Kuwait, Blom Bank, Jordan Dubai Islamic Bank, National Bank of Abu Dhabi and Al Rajhi Bank). Such improvement was meant by the Jordanian government and the CBJ to renew customer confidence in the banking system following the 2008 global financial crises. The H – statistic takes a value between zero and one for the period (2003-2005), (2012-2014), and (2015-2017) in the second model indicating a monopolistic competitive nature in the Jordanian banking system. Hence, empirical findings suggest that the Jordanian commercial banks are competing in a monopolistic competitive nature. That is, banks earned their revenues as if operating under conditions of monopolistic competition during the study period except 2006-2008 (the period of global financial crises). The study results support that high concentration will result in a monopoly as suggested by SCP hypothesis as shown in the result of the sup-period 2006-2008. These results are incompatible with contestable theory. Empirical findings reveal that the Jordanian banking sector is under monopolistic competitive nature, but still close to the monopoly market with high concentration and low competition among banks. the results

indicating that the revenue of Jordanian commercial banks appears to be earned in conditions of monopolistic competition during the sample periods. Our findings not very different from the findings of the most empirical study's findings that have been conducted on the banking sectors in various countries in the same area. The results show a lower degree of competition in the later years of the sample period. The findings of this study are similar to the findings of (Le, 2014; Kashi et al., 2015; and Babic et al., 2015). Thus, our overall findings show that the banking market structure can be characterized as monopolistic competition. This conclusion holds under a variety of specifications controlling for bank-size, risk and other macroeconomic variables. These findings show the need for further deregulations and liberalizations to reduce concentration and enhance competitiveness. The reported results are similar to the findings of (Demirguc-Kunt and Peria, 2010). According to the results reported in Tables 4.8 to 4.12, the elasticity of revenues to the financial resources' cost is mixed. In the models (4.3 and 4.4) where the Revenue (CF) is the dependent variables, the price of labor, and price of capital are positive and significant in most cases, while the ratio of the number of branches of a bank to the total number of branches and the price of funds is negative and significant for most cases.

Regarding the GMM estimations reported in Table 4.13, the lagged values of the profit (ROE) have a positive impact on the current level of ROE. Most of the literature found that firms that have higher than normal profits at a given point in time tend to sustain the profile of high profits over time. Similar evidence regarding banks' profit resilience is rare, profits tend to persist if a bank's past rankings were good predictors of its present ranking as in the study of (Berger et al., 2000) for US banks. This shows that the departure from competitive market structure is not very large in the Jordanian banking sector. Since, according to (Sinha ad Sharma, 2014), profit persistence is strongly affected by the state of competition in the banking sector due to the asymmetry of information. Size also has a negative impact on profitability, suggesting that larger banks have more complicated bureaucratic procedures that affect their profitability negatively. Furthermore, these banks may face lessening marginal returns which causes a decline in their profit shares. The significant and negative impact of diversification on bank profitability suggests that a diversified investment portfolio causes a decline in bank profitability. This result can be explained by the fact that utilizing the bank resources across a variety of businesses reduces the funds available for traditional loan business and precedes a decline in the interest yield, which is one of the biggest revenue sources for banks.

Concentration (C3) has a negative impact on banks' profitability (ROA) while the Lerner index has no statistically significant effect on ROE and ROA. The competitiveness of Jordanian banks has been and continues to be a problem in the Jordanian banking sector, as

concentration is found to impair competitiveness and profitability of the banking sector. This has been observed by (Bikker and Haaf, 2002) for 21 countries (Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Korea (South), Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, UK, US). A high C3 implies that the assets share of the largest three banks is large relative to all other Jordanian commercial banks (Arab Bank, The housing bank for trade and finance, Jordan Ahli Bank). Labor productivity fosters profitability as it reflects the operational efficiency of the bank system. The positive impact of GDP on both profitability measures suggests that an economic boom encourages banks to lend more and permits them to charge higher margins in line with the findings of (Pasiouras and Kosmidou, 2007). It's worth mentioning that years 2005, 2006 and 2007 was the period of economic boom in Jordan which is clearly shown by the highest ratio of ROA (2.0, 1.7, 1.6) and ROE du (20.9, 15.0, 12.6) respectively.

Table 4. 8The Rosse-Panzar H-statistic Results for Jordanian Commercial Banks Competitive Environment and Equilibrium Test Using Commission and Return on Assets (2003-2005).

	Pooled OLS	GLS	Pooled OLS	GLS
VARIABLES	**LnCF**	**LnCF**	**Ln1ROA**	**Ln1ROA**
LnSIZE	4.6055 ***	4.6055***	.1142	.1142
	(.3502)	(.3059)	(.7540)	(.6586)
LnRISkASS	.0688	.0688	.0219	.0219
	(.0538)	(.0470)	(.1158)	(.1012)
LnBR	-.1124	-.1124	-.3689	-.3689
	(.1130)	(.0988)	(.2434)	(.2127)
LnPL	.2655	.2655*	-.6729 *	-.6729**
	(.1842)	(.1609)	(.3966)	(.3465)
LnPF	-.1080	-.1080	-1.6181***	-1.6181***
	(.2549)	(.2227)	(.5489)	(.4795)
LnPK	.1087	.1087	-.1269	-.1269
	(.1436)	(.1255)	(3093)	(.2702)
LnINStoGDP	1.2968	1.2968	5.6592*	5.6592*
	(1.6202)	(1.4154)	(3.4882)	(3.0473)
LnINF	.5429	.5429	2.5742**	2.5742**
	(.5628)	(.4916)	(1.2117)	(1.0585)
Constant	-38.4609	-38.4609	-122.1172	-122.1172 *
	(35.7274)	(31.2111)	(76.9178)	(67.1946)
H-statistic	.2662			
E-Statistic	-2.4180			
Observations	38	38	38	38
R-squared	0.9307		0.5292	
Adj R-squared	0.9116		0.3993	
Prob > chi2		0.0000		0.0000

Where the dependent variables are: CF is the Revenue, ROA and ROE measured the profitability. The independent variables are: PL is the Unit Price of Labor, PK is the Unit Price of Capital, PF is the Unit Price of Funds, BR: Number of Branch, SIZE is the Bank size, RISKASS is the Risk, INStoGDP is the Insurance Premium, INF is the inflation rate. Note: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. H1= .2655058 + -.1080146 + .1087972 = .2662884. E1 = -.6729218 + -1.618153 + -.1269571 = -2.4180619.

Table 4. 9The Rosse-Panzar H-statistic Results for Jordanian Commercial Banks Competitive Environment and Equilibrium Test Using Commission and Return on Assets (2006-2008).

	Pooled OLS	GLS	Pooled OLS	GLS
VARIABLES	**LnCF**	**LnCF**	**Ln1ROA**	**Ln1ROA**
LnSIZE	4.2496***	4.2496***	-.2111	.03015
	(.4761)	(.4142)	(.2527)	(.6185)
LnRISkASS	.0656*	.0656*	-.0479 **	.0058
	(.0432)	(.0375)	(.0229)	(.0561)
LnBR	-.1089	-.1089	.1071	-.0893
	(.2042)	(.1777)	(.1084)	(.2653)
LnPL	-.0135	-.0135	-.1245	.2829
	(.2056)	(.1788)	(.1091)	(.2670)
LnPF	-.6916*	-.6916*	.1096	.0655
	(.4496)	(.3911)	(.2386)	(.5840)
LnPK	.1285	.1285	.1136*	.2123
	(.1424)	(.1238)	(.0755)	(.1849)
LnINStoGDP	1.2816*	1.2816*	-1.0125**	-1.5890*
	(.8057)	(.7009)	(.4276)	(1.0466)
LnINF	-.4473	-.4473	.4912***	.7654*
	(.3560)	(.3097)	(.1889)	(.4624)
Constant	-30.39*	-30.3919*	22.9418***	36.1595 *
	(16.082)	(13.9900)	(8.5363)	(20.8903)
H-statistic	-.5767			
E-Statistic	.0986			
Observations	37	37	37	37
R-squared	0.9364		0.3547	
Adj R-squared	0.9182		0.1703	
Prob > chi2		0.0000		0.3765

Where the dependent variables are:, CF is the Revenue, ROA and ROE measured the profitability. The independent variables are: PL is the Unit Price of Labor, PK is the Unit Price of Capital, PF is the Unit Price of Funds, BR: Number of Branch, SIZE is the Bank size, RISKASS is the Risk, INStoGDP is the Insurance Premium, INF is the inflation rate. Note: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. H1= -.0135975 + -.6916956 + .1285122 = -.5767809. E1 = -.1245797 + .1096084 + .1136269 = .0986556.

Table 4. 10The Rosse-Panzar H-statistic Results for Jordanian Commercial Banks Competitive Environment and Equilibrium Test Using Commission and Return on Assets (2009-2011).

	Pooled OLS	GLS	Pooled OLS	GLS
VARIABLES	**LnCF**	**LnCF**	**Ln1ROA**	**Ln1ROA**
LnSIZE	5.1588 ***	5.1588 ***	-.5271	-.1852
	(.4760)	(.4174)	(.3713)	(.8945)
LnRISkASS	-.0793	-.0793**	-.0099	-.1033
	(.0557)	(.0489)	(.0435)	(.1047)
LnBR	.1520	.1520	-.2708 *	-.7017**
	(.1900)	(.16665)	(.1482)	(.3570)
LnPL	.1216	.1216	.1489	.8458
	(.3188)	(.2796)	(.2487)	(.5990)
LnPF	1.1170**	1.1170***	-1.5865 ***	-2.9388***
	(.4563)	(.4002)	(.3559)	(.8574)
LnPK	-.1042	-.1042	.0715	.0411
	(.0895)	(.0785)	(.0698)	(.1683)
LnINStoGDP	.1662	.1662	-2.0823*	-5.6148 **
	(1.4089)	(1.2357)	(1.0991)	(2.6477)
LnINF	.1373	.1373	-.3114***	-.6017***
	(.1138)	(.0998)	(.0887)	(.2138)
Constant	-22.0692	-22.0692	59.588***	146.1527**
	(33.2807)	(29.1891)	(25.9623)	(62.5409)
H-statistic	1.1344102			
E-Statistic	-1.3660736			
Observations	39	39	39	39
R-squared	0.9447		0.5189	
Adj R-squared	0.9300		0.3906	
Prob > chi2		0.0000		0.0001

Where the dependent variables are: CF is the Revenue, ROA and ROE measured the profitability. The independent variables are: PL is the Unit Price of Labor, PK is the Unit Price of Capital, PF is the Unit Price of Funds, BR: Number of Branch, SIZE is the Bank size, RISKASS is the Risk, INStoGDP is the Insurance Premium, INF is the inflation rate. Note: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. H1= .1216269 + 1.117041 + -.1042577 = 1.1344102. E1 = .148954 + -1.586585 + .0715574 = -1.3660736.

Table 4. 11The Rosse-Panzar H-statistic Results for Jordanian Commercial Banks Competitive Environment and Equilibrium Test Using Commission and Return on Assets (2012-2014).

	Pooled OLS	GLS	Pooled OLS	GLS
VARIABLES	**LnCF**	**LnCF**	**Ln1ROA**	**Ln1ROA**
LnSIZE	6.1027***	6.1027***	.3939*	.5236*
	(.5073)	(.4450)	(.2174)	(.3380)
LnRISkASS	.0148	.0148	-.1104***	-.1398***
	(.0759)	(.0666)	(.0325)	(.0506)
LnBR	-.44927**	-.4492***	-.1929**	-.2577**
	(.1830)	(.1605)	(.0784)	(.1219)
LnPL	1.0008***	1.0008***	.2114 *	.3857 **
	(.2877)	(.2523)	(.1233)	(.1917)
LnPF	-.1482	-.1482	-.3947**	-.7212***
	(.3628)	(.3182)	(.1554)	(.2417)
LnPK	.0367	.0367	.1635	.1876**
	(.1409)	(.1236)	(.0604)	(.0939)
LnINStoGDP	-7.4724	-7.4724	1.3035	7.5620
	(11.5126)	(10.0972)	(4.9338)	(7.6714)
LnINF	.3667	.3667	-.0499	-.3351
	(.4003)	(.3511)	(.1715)	(.2667)
Constant	152.0335	152.0335	-31.2571	-174.7259
	(268.0868)	(235.1276)	(114.8908)	(178.6397)
H-statistic	.88934			
E-Statistic	-.01971			
Observations	39	39	39	39
R-squared	0.9123		0.5226	
Adj R-squared	0.8889		0.3952	
Prob > chi2		0.0000		0.0000

Where the dependent variables are: CF is the Revenue, ROA and ROE measured the profitability. The independent variables are: PL is the Unit Price of Labor, PK is the Unit Price of Capital, PF is the Unit Price of Funds, BR: Number of Branch, SIZE is the Bank size, RISKASS is the Risk, INStoGDP is the Insurance Premium, INF is the inflation rate. Note: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. H1= 1.000838 + -.1482142 + .0367215 = .8893453. E1 = .211475 + -.3947703 + .1635796 = -.0197157.

Table 4. 12The Rosse-Panzar H-statistic Results for Jordanian Commercial Banks Competitive Environment and Equilibrium Test Using Commission and Return on Assets (2015-2017).

	Pooled OLS	GLS	Pooled OLS	GLS
VARIABLES	**LnCF**	**LnCF**	**Ln1ROA**	**Ln1ROA**
LnSIZE	5.4571 ***	5.4571***	-.3293	-.7575 *
	(.6364)	(.5582)	(2645)	(.4090)
LnRISkASS	.0835	.0835	-.0049	-.0067
	(.0863)	(.0757)	(.0358)	(.0555)
LnBR	-.4411**	-.4411**	-.0494	.0717
	(.2058)	(.1805)	(.0855)	(.1323)
LnPL	.6348 **	.6348 **	.1187	.0531
	(.2978)	(.2611)	(.1237)	(.1913)
LnPF	-.4710	-.4710	-.4788***	-.5205 **
	(.3698)	(.3243)	(.1537)	(.2376)
LnPK	.1244	.1244	-.0340	-.1738
	(.1979)	(.1735)	(.0822)	(.1271)
LnINStoGDP	-1.1201	-1.1201	-.8048	-1.1850
	(1.6838)	(1.4767)	(.6997)	(1.0820)
LnINF	.0775	.0775*	.0066	.0017
	(.0503)	(.0441)	(.0209)	(.0323)
Constant	10.9714	10.9714	24.7471	40.4673
	(39.7404)	(34.8546)	(16.5156)	(25.5384)
H-statistic	.2882			
E-Statistic	-.3941			
Observations	39	39	39	39
R-squared	0.8232		0.3960	
Adj R-squared	0.7760		0.2350	
Prob > chi2		0.0000		0.0156

Where the dependent variables are: CF is the Revenue, ROA and ROE measured the profitability. The independent variables are: PL is the Unit Price of Labor, PK is the Unit Price of Capital, PF is the Unit Price of Funds, BR: Number of Branch, SIZE is the Bank size, RISKASS is the Risk, INStoGDP is the Insurance Premium, INF is the inflation rate. Note: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. H1= .6348226 + -.4710039 + .1244514 = .2882701. E1 = .1187637+ -.4788663 + -.0340204 = -.394123.

Table 4. 13Empirical Results of GMM Model of the Impact of competition (Lerner Index) on the Jordanian Commercial Banks Profitability (2003-2015).

VARIABLES	ROA	ROE
L.ROA	-0.00331	
	(0.0497)	
L2.ROA	-0.247***	
	(0.0475)	
L.ROE		-0.132**
		(0.0631)
L2.ROE		-0.0916*
		(0.0552)
SIZE	-0.816**	-8.505***
	(0.326)	(2.866)
LLPTL	-0.00680	-0.00682
	(0.00484)	(0.0413)
CAP	0.0332**	-0.181
	(0.0149)	(0.122)
LIQUIDITY	0.00171	-0.0220
	(0.00430)	(0.0376)
DIV	-0.0241***	-0.163**
	(0.00835)	(0.0704)
TAXATION	-0.000922	-0.00514
	(0.000601)	(0.00549)
Lerner	0.121	-1.332
	(0.535)	(4.330)
CO3	-0.0611**	-0.611***
	(0.0285)	(0.225)
LP	2.363***	17.86***
	(0.396)	(3.371)
SMD	-0.00578	0.00283
	(0.00531)	(0.0484)
GDP	0.121***	0.398*
	(0.0251)	(0.218)
INF	-0.00500	0.0915
	(0.00890)	(0.0764)
Constant	4.508	84.04***
	(4.208)	(32.07)
Observations	141	141

Number of Bank	13	13

Where the dependent variables are: ROA and ROE measured the profitability. The independent variables are SIZE is the Bank size, LLPTL is the Bank risk, LIQUIDITY is the Liquidity, CAP is the Capitalization, DIV is the Diversification, LP is the Labor productivity, TAXATION is the Taxation, Lerner is the Competition, CO3 is the Concentration, SMD is the Stock market development, INF is the inflation annual rate. GDP is the GDP growth rate. Note: Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

4.4.2 Liquidity risk results

The estimations result of the liquidity risk models appear in Tables 4.14 and 4.15. The models are estimated using Pooled OLS, FE, RE methods. We hypothesize a significant and positive relationship between liquidity risk and profitability for Jordanian commercial banks (H2). Liquidity risk is measured by total loans to total deposits (LTD). Our results confirm our hypothesis wherein liquidity risk has a significant positive impact, but only for ROE and Q models with coefficients of 0.05 and 0.001 respectively. (Tafri et al., 2009) and (Alshatti, 2016) found a similar insignificant effect of the loan to deposits ratio on bank profitability. Our results are in line with (Bourke, 1989) who found evidence of a positive relationship between liquidity risk and bank profitability for 90 banks in Europe, North America, and Australia. The positive relationship between LTD and the Jordanian bank profitability shows that for the period represented by the data that Jordanian commercial banks used their fund resources efficiently. The management of bank resources was one of the major concerns for CBJ regulators who imposed on sight monitoring during the period of banking reform.

With regard to bank size, similar to the competition models, the size coefficients in the ROA, ROE, Tobin Q, and EVA models are -1.39, -2.26, -0.18, and -0.87 respectively. The data suggests that larger banks have more complicated bureaucratic procedures that have affect their profitability negatively. Also, it is likely that these banks may have faced reduced marginal returns, which would have resulted in declining profitability compared with their size as suggested by (Staikouras and Wood, 2011) and (Ani et al. 2012). This result also suggests that higher total assets may not necessarily lead to higher profits. The results may also be linked to diseconomies of scale suffered by Jordanian banks due to the uncontrolled increase in the number of deposits and to the inward migration of Iraqi and Syrian refugees to Jordan.

Capital Adequacy Ratio (Tier-1) and Equity to Assets (ETA) both have a robust negative effect on ROE as shows in table 4.19 and 4.20. Generally, capital adequacy is used

by bank regulators to control banks' ability to withstand a certain amount of losses. The inward migration of Syrian and Iraqi refugees contributed to the increase in capital adequacy, size of branches and the capital of Jordanian commercial banks. The capital adequacy ratio in Jordan reached 12 percent in 2015 exceeding the CBJ minimum rate of 8 percent. Our results are in line with (Al-Tarawneh et al., 2016) who found a negative correlation between capital adequacy and Jordanian banks' profitability. The negative ETA indicates that during the period examined, Jordanian banks adopted a tighter loan policy and, at the same time, maintained a large share of capital to offset potential losses or crises. These results also highlight the success of CBJ reforms. Since 1989 the CBJ has initiated a number of reforms to make the banking system more secure via increasing the paid-up capital of Jordanian banks to JD 100 million. These findings also support the argument that well-capitalized banks face lower chances of bankruptcy (Hassan and Bashir, 2003, Bashir, 2003, and Sufian and Habibullah, 2009).

We use the Net Interest Margin (NIM) to investigate the impact of the interest environment on bank performance. In line with our hypothesis, NIM has a positive and statistically significant impact on ROA and ROE. A one percentage increase in NIM fosters ROA and ROE with 0.18 percent and 0.80 percent respectively. This result corresponds to the fact that the interest yield is the main source of income for Jordanian banks amounting to 77.4 percent of total income in 2015. (Khrawish and Al-Sa'di, 2011) found a similar positive relationship between ROA, ROE, and NIM. These results correspond with Jordanian banks' attempts to extend offered loans while preserving the low levels of Non-Performing Loans (NPL). The ratio of non-performing loans to total loans continued its downward trend at the end of 2015 to touch 4.9 percent compared to 7.7 percent, 6.8 percent and 5.6 percent at the end of 2012, 2013 and 2014 respectively. The coverage ratio for the nonperforming loans reached 75.0 percent at the end of 2015. Bank net interest margin in Jordan was 2.16 percent in 2003 and 3.23 percent in 2015. This was induced by the increase in the amounts of offered loans from Jordanian banks to the households, businesses, and government (in general, the larger the value of the loan, the greater the net interest margin will be, and the higher the bank profits are). In line with the increase in bank loans, Jordanian banking sector credit facilities grew to 9.6 percent to reach 21.1 billion JD in 2015.

The cost of fund (COF) has also a significant negative impact on ROA, ROE, Q, and EVA with coefficients of -0.99, -0.76, -0.008, and -1.27 respectively. The COF measures the impact of bank managements' efficiency over banks' profitability. Therefore, a bank with

excellent managerial efficiency will be able to collect low-cost funds, thus enhancing profitability levels (Dietrich ans Wanzenried, 2011). The negative relationship between COF and Jordanian banks' profitability is consistent with the fact that banks with higher capital ratios tend to face a lower cost of funding due to lower prospective bankruptcy costs as reported by (Demirgüç-Kunt and Huizinga, 1999) and (Pasiouras and Kosmidou, 2007). These results also support the successful attempts by the CBJ to lower the cost of funds through increased banking sector liquidity while also inducing banks to lower their lending rates and to expand credit facilities.

Cost to Income (CTI) negatively influences banks' profitability. CTI coefficients with ROA, ROE Q, and EVA are -0.02, -0.19, -0.001, and -0.042 respectively. CTI is another indicator of the operational efficiency of the Jordanian commercial banks, where a high ratio implies less efficient management. This result meets our expectation that improvements in efficiency feed into higher profitability. (Trujillo-Ponce, 2013) and (Athanasoglou et al., 2008) found similar effects of higher CTI on the reduction of banks' profitability. As a part of the CBJ objectives during the reform phase, the CBJ designed a unified e-banking methodology for all processes and for all clients, and also introduced many technological tools to improve banks' overall operational efficiency.

Concentration (C3) has a negative impact on banks' profitability (ROA). A high C3 implies that the assets share of the largest three banks, (Arab Bank, the housing bank for trade and finance, Jordan Ahli Bank) is large relative to all other Jordanian commercial banks. A slight improvement is also observed, over a period of 10 years, wherein the concentration ratio decreased from 60 percent to 53.9 percent in 2015. The analysis provides robust evidence about the negative impact of concentration on the Jordanian bank profitability by measuring concentration using assets, loans and deposits.

Regarding the macroeconomic indicators and similar to the competition models, GDP growth influences banks' profitability. This result is in line with (Samhan and Al-Khitab, 2015) and suggests that Jordanian banks operate better and earn more profits during good economic conditions. One reason is that during boom periods (2005, 2006, and 2007) the loan loss provisions will be low, which improves the quality of banks' assets and reduce the chances of default risks. The relationship between inflation and profitability depends on whether inflation expectations are fully anticipated or not. Inflation has a modest negative impact on only one of the profitability indicators (Q), reflecting the inability of banks to

accurately predict the levels of inflation. Accordingly, banks lose the opportunity to benefit from the inflationary environment to stimulate profits.

Table 4. 14Empirical Results of Pooled OLS of the Impact of Liquidity Risk on the Jordanian Commercial Banks Profitability (2003-2015), CO3 measured by Total Assets.

	(ROA)	(ROE)	(Tobin)	(EVA)
VARIABLES	**Pooled OLS**	**Pooled OLS**	**Pooled OLS**	**Pooled OLS**
SIZE	-0.214**	-2.264***	0.0113	-1.711***
	(0.084)	(0.729)	(0.015)	(0.564)
TIER1	-0.0197**	-0.197**	0.00146	-0.141**
	(0.0092)	(0.0796)	(0.0016)	(0.0616)
LTD	0.00273	0.0537**	0.0011**	0.0037
	(0.0025)	(0.0223)	(0.0004)	(0.0172)
ETA	0.0396**	-0.542***	-0.0008	0.0858
	(0.0171)	(0.147)	(0.0030)	(0.114)
NIM	0.188***	0.801	0.0022	0.535
	(0.0574)	(0.494)	(0.0102)	(0.382)
COF	-0.113***	-0.765**	-0.0193**	-0.971***
	(0.0407)	(0.350)	(0.0075)	(0.271)
CTI	-0.0233***	-0.195***	-0.0009**	-0.0479***
	(0.0021)	(0.0184)	(0.0003)	(0.0142)
CO3	0.0035	0.0852	0.0045*	0.0324
	(0.0154)	(0.133)	(0.0027)	(0.103)
GDP	0.0682***	0.240	0.0295***	-0.206
	(0.0224)	(0.192)	(0.00397)	(0.149)
INF	0.0002	0.0362	-0.0031	0.0066
	(0.0109)	(0.0936)	(0.0019)	(0.0725)
Constant	3.586**	42.62***	0.556**	21.46**
	(1.468)	(12.62)	(0.262)	(9.775)
Observations	154	154	153	154
R-squared	0.654	0.621	0.611	0.270
F	0.0000	0.0000	0.0000	0.0000
Number of banks	13	13	13	13

Where the dependent variables are: ROA and ROE is the profitability measurement, Tobin is the Tobin's Q ratio, EVA is the Economic Value Added. The independent variables are: SIZE is the Bank size, TIER1 is the Capital Adequacy ratio-TIER 1, LTD is the Liquidity Risk, ETA is the Capitalization, NIM is the Net interest margin ratio, CTI is the Cost to income ratio, COF is the Cost of fund ratio, CO (3), is the Concentration, GDP is the GDP rate, INF is the inflation rate Note: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 4. 15Empirical Results of Fixed and Random Effect Model of the Impact of Liquidity Risk on the Jordanian Commercial Banks Profitability (2003-2015). CO3 measured by Total Assets

	(ROA)	(ROE)	(Tobin)	(EVA)
VARIABLES	**FE**	**RE**	**FE**	**RE**
Size	-1.3979***	-2.264***	-.1872***	-.8728
	(.4222)	(.7288)	(.0611)	(1.135)
TIER1	-.0006	-.1966***	-.0027	-.0335
	(.0146)	(.0795)	(.0021)	(.0774)
LTD	.0037	.0537***	.0011***	.0123
	(.0033)	(.0222)	(.0004)	(.0187)
ETA	.0130	-.5416***	-.0041	.0637
	(.022)	(.1469)	(.0032)	(.1186)
NIM	.0751	.8005*	-.0006	-.3479
	(.1038)	(.4937)	(.0150)	(.5237)
COF	-.0999**	-.7647***	-.0058	-1.277***
	(.0465)	(.3500)	(.0069)	(.2592)
CTI	-.0223***	-.1954***	-.0011***	-.0424***
	(.0024)	(.0183)	(.0003)	(.0136)
CO3	-.0545***	.0851	-.0032	-.0244
	(.0222)	(.1326)	(.0032)	(.1009)
GDP	.0469**	.2395	.0261***	-.1680
	(.0247)	(.1923)	(.0035)	(.1346)
INF	.0048	.0362	-.0030**	.0509
	(.0108)	(.0935)	(.0015)	(.0639)
Observations	154	154	153	154
R-squared (Overall)	0.280	0.621	0.221	0.197
F	0.0000	0.0000	0.0000	0.0000
Number of banks	13	13	13	13

Where the dependent variables are: ROA and ROE is the profitability measurement, Tobin is the Tobin's Q ratio, EVA is the Economic Value Added. The independent variables are: SIZE is the Bank size, TIER1 is the Capital Adequacy ratio-TIER 1, LTD is the Liquidity Risk, ETA is the Capitalization, NIM is the Net interest margin ratio, CTI is the Cost to income ratio, COF is the Cost of fund ratio, CO (3), is the Concentration, GDP is the GDP rate, INF is the inflation rate Note: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 4. 16Empirical Results of Pooled OLS for the Impact of Liquidity Risk on the Jordanian Commercial Banks Profitability (2003-2015), CO3 measured by Total Loans.

	(ROA)	(ROE)	(Tobin)	(EVA)
VARIABLES	**Pooled OLS**	**Pooled OLS**	**Pooled OLS**	**Pooled OLS**
SIZE	-0.214**	-2.335***	0.00740	-1.794***
	(0.0830)	(0.715)	(0.0148)	(0.552)
TIER1	-0.0203**	-0.195**	0.00154	-0.130**
	(0.00924)	(0.0796)	(0.00164)	(0.0614)
LTD	0.00282	0.0561**	0.00126***	0.00477
	(0.00255)	(0.0219)	(0.000452)	(0.0169)
ETA	0.0404**	-0.545***	-0.000968	0.0691
	(0.0170)	(0.147)	(0.00302)	(0.113)
NIM	0.186***	0.748	-0.000687	0.526
	(0.0567)	(0.489)	(0.0101)	(0.377)
COF	-0.118***	-0.837**	-0.0235***	-0.980***
	(0.0391)	(0.337)	(0.00730)	(0.260)
CTI	-0.0236***	-0.194***	-0.000875**	-0.0420***
	(0.00210)	(0.0181)	(0.000374)	(0.0140)
CO3	-1.043*	-6.167*	0.355	-9.680
	(1.491)	(12.85)	(0.265)	(9.913)
GDP	0.0596**	0.252	0.0298***	-0.0608
	(0.0239)	(0.206)	(0.00428)	(0.159)
INF	-0.000501	0.0312	-0.00339*	0.0126
	(0.0109)	(0.0940)	(0.00196)	(0.0725)
Constant	3.124**	44.64***	0.648***	30.62***
	(1.386)	(11.94)	(0.247)	(9.215)
Observations	154	154	154	154
R-squared	0.655	0.621	0.608	0.274
F	0.0000	0.0000	0.0000	0.0000
Number of banks	13	13	13	13

Where the dependent variables are: ROA and ROE is the profitability measurement, Tobin is the Tobin's Q ratio, EVA is the Economic Value Added. The independent variables are: SIZE is the Bank size, TIER1 is the Capital Adequacy ratio-TIER 1, LTD is the Liquidity Risk, ETA is the Capitalization, NIM is the Net interest margin ratio, CTI is the Cost to income ratio, COF is the Cost of fund ratio, CO (3), is the Concentration, GDP is the GDP rate, INF is the inflation rate Note: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 4. 17Empirical Results of Fixed and Random Effect Model for the Impact of Liquidity Risk on the Jordanian Commercial Banks Profitability (2003-2015). CO3 measured by Total Loans

	(ROA)	(ROE)	(Tobin)	(EVA)
VARIABLES	**RE**	**FE**	**FE**	**RE**
Size	-0.214***	-11.91***	-0.239***	-1.502
	(0.0830)	(3.885)	(0.0664)	(1.094)
TIER1	-0.0203**	0.0127	-0.00243	-0.0170
	(0.00924)	(0.122)	(0.00208)	(0.0761)
LTD	0.00282	0.0392	0.000958*	0.0109
	(0.00255)	(0.0288)	(0.000492)	(0.0184)
ETA	0.0404**	-0.737***	-0.00483	0.0344
	(0.0170)	(0.185)	(0.00316)	(0.116)
NIM	0.186***	0.0919	-0.00124	-0.346
	(0.0567)	(0.867)	(0.0148)	(0.513)
COF	-0.118***	-0.188	0.00193	-1.191***
	(0.0391)	(0.451)	(0.00801)	(0.253)
CTI	-0.0236***	-0.187***	-0.00114***	-0.0371***
	(0.00210)	(0.0199)	(0.000343)	(0.0133)
CO3	1.043	-42.08**	-0.647*	-16.69*
	(1.491)	(20.05)	(0.344)	(9.660)
GDP	0.0596**	0.140	0.0270***	-0.0394
	(0.0239)	(0.209)	(0.00360)	(0.140)
INF	-0.000501	0.0927	-0.00256	0.0641
	(0.0109)	(0.0928)	(0.00160)	(0.0639)
Observations	154	154	153	154
R-squared (Overall)	0.964	0.095	0.107	0.080
F	0.0000	0.0000	0.0000	0.0000
Number of banks	13	13	13	13

Where the dependent variables are: ROA and ROE is the profitability measurement, Tobin is the Tobin's Q ratio, EVA is the Economic Value Added. The independent variables are: SIZE is the Bank size, TIER1 is the Capital Adequacy ratio-TIER 1, LTD is the Liquidity Risk, ETA is the Capitalization, NIM is the Net interest margin ratio, CTI is the Cost to income ratio, COF is the Cost of fund ratio, CO (3), is the Concentration, GDP is the GDP rate, INF is the inflation rate Note: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 4. 18Empirical Results of Pooled OLS for the Impact of Liquidity Risk on the Jordanian Commercial Banks Profitability (2003-2015) , CO3 measured by Total Deposits.

	(ROA)	(ROE)	(Tobin)	(EVA)
VARIABLES	**Pooled OLS**	**Pooled OLS**	**Pooled OLS**	**Pooled OLS**
SIZE	-0.178**	-2.004***	0.0165	-1.613***
	(0.0848)	(0.730)	(0.0150)	(0.570)
TIER1	-0.0217**	-0.210***	0.00125	-0.146**
	(0.00914)	(0.0787)	(0.00161)	(0.0614)
LTD	0.00196	0.0486**	0.00105**	0.00180
	(0.00256)	(0.0221)	(0.000451)	(0.0172)
ETA	0.0430**	-0.519***	-0.000431	0.0943
	(0.0169)	(0.145)	(0.00297)	(0.114)
NIM	0.207***	0.932*	0.00501	0.585
	(0.0572)	(0.492)	(0.0101)	(0.384)
COF	-0.0908**	-0.607*	-0.0162**	-0.912***
	(0.0409)	(0.352)	(0.00755)	(0.275)
CTI	-0.0246***	-0.204***	-0.00110***	-0.0512***
	(0.00213)	(0.0183)	(0.000376)	(0.0143)
CO3	-3.043*	-26.59*	0.780***	-10.03
	(1.640)	(14.11)	(0.288)	(11.02)
GDP	0.0382	0.0300	0.0254***	-0.285*
	(0.0243)	(0.209)	(0.00429)	(0.163)
INF	-0.00144	0.0211	-0.00362*	0.000907
	(0.0108)	(0.0929)	(0.00192)	(0.0725)
Constant	1.307	26.70*	0.239	15.47
	(1.644)	(14.15)	(0.291)	(11.05)
Observations	154	154	153	154
R-squared	0.662	0.629	0.623	0.274
F	0.0000	0.0000	0.0000	0.0000
Number of banks	13	13	13	13

Where the dependent variables are: ROA and ROE is the profitability measurement, Tobin is the Tobin's Q ratio, EVA is the Economic Value Added. The independent variables are: SIZE is the Bank size, TIER1 is the Capital Adequacy ratio-TIER 1, LTD is the Liquidity Risk, ETA is the Capitalization, NIM is the Net interest margin ratio, CTI is the Cost to income ratio, COF is the Cost of fund ratio, CO (3), is the Concentration, GDP is the GDP rate, INF is the inflation rate Note: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 4. 19Empirical Results of Fixed and Random Effect Model for the Impact of Liquidity Risk on the Jordanian Commercial Banks Profitability (2003-2015). CO3 measured by Total Deposits

	(ROA)	(ROE)	(Tobin)	(EVA)
VARIABLES	**RE**	**FE**	**FE**	**RE**
Size	-0.178**	-4.967	-0.142*	-0.488
	(0.0848)	(4.723)	(0.0806)	(1.206)
TIER1	-0.0217**	-0.0542	-0.00334	-0.0429
	(0.00914)	(0.127)	(0.00217)	(0.0778)
LTD	0.00196	0.0506*	0.00113**	0.0111
	(0.00256)	(0.0287)	(0.000491)	(0.0187)
ETA	0.0430**	-0.600***	-0.00298	0.0830
	(0.0169)	(0.202)	(0.00344)	(0.119)
NIM	0.207***	0.274	0.00113	-0.312
	(0.0572)	(0.899)	(0.0153)	(0.529)
COF	-0.0908**	-0.661*	-0.00566	-1.235***
	(0.0409)	(0.397)	(0.00702)	(0.263)
CTI	-0.0246***	-0.188***	-0.00116***	-0.0455***
	(0.00213)	(0.0205)	(0.000351)	(0.0138)
CO3	-3.043*	-4.960	0.00746	-4.774*
	(1.640)	(26.92)	(0.459)	(11.45)
GDP	0.0382	0.0392	0.0256***	-0.225
	(0.0243)	(0.216)	(0.00369)	(0.146)
INF	-0.00144	0.0488	-0.00313*	0.0468
	(0.0108)	(0.0959)	(0.00166)	(0.0645)
Observations	154	154	153	154
R-squared (Overall)	0.972	0.542	0.716	0.061
F	0.0000	0.0000	0.0000	0.0000
Number of banks	13	13	13	13

Where the dependent variables are: ROA and ROE is the profitability measurement, Tobin is the Tobin's Q ratio, EVA is the Economic Value Added. The independent variables are: SIZE is the Bank size, TIER1 is the Capital Adequacy ratio-TIER 1, LTD is the Liquidity Risk, ETA is the Capitalization, NIM is the Net interest margin ratio, CTI is the Cost to income ratio, COF is the Cost of fund ratio, CO (3), is the Concentration, GDP is the GDP rate, INF is the inflation rate Note: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

4.4.3 Interest rate results

The estimations result of the interest rate and risk-taking models appear in Tables 4.20 - 4.222. The models are estimated using Pooled OLS and GMM methods. This section empirically investigates the impact of bank-specific, interest rate environment, and macroeconomic factors on bank profitability and risk-taking.

Unlike the competition and liquidity risk models, size has a positive and significant impact on the profit and ROE (Table 4.20 and 4.21). The result suggests that larger banks are more profitable mainly due to economies of scale (Khan et al., 2017). However, the results also show that size reduces some profitability indicators such as ROA and profit margin, which can be explained by the adverse effects of the bureaucratic and routine procedures on banks' performance and profit. There is also non-robust evidence of the impact of size on the TCR and PCL risk measures. The statistics for Size shown in Table 4.20 suggests that this variable reduces risk and that larger banks are more able to mitigate potential credit risks relative to smaller banks.

Capitalization has a significant and positive impact on all profitability measures. (Al-Smadi et al., 1970) found a similar relationship between bank capital and profitability of Jordanian banks Higher bank capitalization is reflected in a better ability to manage assets and generate profits (Demirgüç-Kunt and Huizinga, 1999). The CBJ efforts during the period represented by the data contributed to the improvement in stability and soundness of the monetary and financial systems, resulting in an increase in the capital ratio of the commercial banks. The high level of capital is also a good indicator of the ability of banks to hedge against risks. On the other side, capitalization increases both risk and credit measures, as large banks have a big loan portfolio that translates into higher levels of provision. Tables 4.20 and 4.21 shows that diversification adversely affect the banks' profitability measures similar to the competition results. Jordanian commercial banks that relied heavily on non-interest income (higher diversification) tend to be less profitable. A similar result was confirmed by (Demirgüç-Kunt and Huizinga, 1999) in their study of 80 countries Non-interest income in banks is generated via fees and commissions income or trading activities. The risk measures – total capital ratio and credit risk have negative and statically significant associations with the profitability measures. In line with (Bikker and Hu, 2002) and (Bolt et al., 2012) higher credit risk exposure via loans is associated with lower profit margins.

The statistics suggests that short-term interest rate has no significant impact on

profitability and risk measures (Table 4.20, 4.21and 4.22). The result could be explained by the fact that the CBJ adopted low-interest-rate schemes during the reform phases, adversely affecting the banks' lending behavior and the volume of their interest yields. As a result, Jordanian banks started to use a wide range of products and services to improve banks' profitability and become less reliant on interest income. Table 4.21 also shows that lending had a positive influence on two profitability measures (NIM and Profit). A similar result was found by (Dietrich and Wanzenried, 2011). As the relative size of lending increases, banks become better able at boosting their revenue from the interest income.

GDP has a significant negative impact on profitability measures as shown in Table 4.21, contrary to the results of model reported in Table 4.25. One explanation for this could be that high economic growth aligned with the CBJ reforms improved the business environment, lowered bank entry barriers, and enhanced the competitiveness of banks. The subsequent increased competition could also have dampened banks' overall profitability as (Tan and Floros, 2012) found in their study a negative relationship between bank competition and profitability. The results in Table 4.26 show that Inflation reduces profitability measures (ROA, ROE, and Profit Margin). The negative profitability effect of inflation reflects the inability of Jordanian banks to anticipate inflation and so benefit from the inflationary environment to enhance bank profits.

Table 4. 20Empirical Results of the Pooled OLS for the impact of interest rate on Jordanian Commercial Banks Profitability and Risk-taking taking (2003- 2015).

	(NIM)	(ROA)	(ROE)	(Profit)	(PM)	(TCR)	(PCL)
VARIABLES	**Pooled OLS**	**Pooled OLS**	**Pooled OLS**	**Pooled OLS**	**Pooled OLS**	**Pooled OLS**	**Pooled OLS**
SIZE	.1449*	-.1048	1.744**-	1.277***	-.1014	-1.069 **	-.7603***
	(.0886)	(0.0943)	(.8210)	(.0508)	(.1232)	(.4476)	(.2761)
CAP	-.0221	.0798**	-.2226	.0364*	.0917*	1.206***	.3703***
	(.0351)	(0.0374)	(.3257)	(.0201)	(.0488)	(.1204)	(0 .1066)
DIV	-.0405***	-.0428***	-.2756***	-.0184***	-.0648***	-.1676***	-.0403
	(.0109)	(.0116)	(.1013)	(.0062)	(.0152)	(.0539)	(0 .0354)
lEN	.0178*	-.0083	-.0132	.0104*	-.0090	-.2284***	-.2136***
	(.0102)	(.0109)	(.0952)	(.0059)	(.0142)	(.0469)	(0 .0228)
PCL	-.0071	-.0922**	-.9101***	-.0112	-.1146**	-.6401***	
	(.0353)	(0.0375)	(.3271)	(.0202)	(0 .0490)	(.1696)	
TCR	.0026	-.0439*	-.3697*	-.0255**	-.0507*		-.2492***
	(.0220)	(.0234)	(.2041)	(.0126)	(0. .0306)		(0.0660)
INF	.0387	-.0065	0.0156	.0036	-.0076	.1595	.0944
	(.0218)	(0 .0232)	(.2026)	(.0098)	(0.0304)	(.1595)	(0.0706)
GDP	-.0403	0.0717	.5358	.0387*	.098*	.2875	-.1072
	(.0416)	(0.0442)	(.3853)	(.0238)	(0.0578)	(.2154)	(0 .1354)
SHTI	-.0410	-0.5719	-2.596	-.0814	-.7712	-2.738	-2.029*
	(.3690)	(0.3925)	(3.416)	(.2116)	(0 .5126)	(1.906)	(1.182)
SHTI2	.0021	0.0750*	3231.	.0028	.1010	.2252	.1797
	(.0388)	(0.0413)	(.3597)	(.0222)	(0.0539)	(.2018)	(0.1252)
Number of Obs	85	85	85	85	85	85	85

Where the dependent variables are: NIM is the Net Interest Margin, ROA and the ROE measured the profitability, Profit is the Total Profit, PM: is the Profit Margin, TCR is the Total Capital Ratio, PCL is the Credit Risk. The independent variables are: SIZE is the Bank size, CAP is the Capitalization, DIV is the Diversification, LEN is the Lending, GDP is the Real GDP Growth, INF is the Inflation rate, SHTI is the Short-term interest rate. Note: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 4. 21Empirical Static Results of Instrumental Variable Estimation of the impact of interest rate on Jordanian Commercial banks Profitability and Risk-taking (2003 -2015).

	(NIM)	(ROA)	(ROE)	(Profit)	(PM)	(TCR)	(PCL)
VARIABLES	GMM	GMM	GMM	GMM	GMM	GMM	GMM
SIZE	-0.1755	-0.1048	-3.164	1.277***	-0.7682	-.6659	0.3663
	(0.2215)	(0.0943)	(5.720)	(0.0474)	(1.0426)	(.8961)	(1.249)
CAP	0.1343***	0.0798**	-.1693	0.0364*	0.1326**	.8632***	0.1563
	(0.0401)	(0.0374)	(0.5119)	(0.0188)	(0.0505)	(0.2544)	(0.1432)
DIV	-0.0028	-0.0428***	-0.2726	-0.0184***	-0.0399	0.0680	-0.1048
	(0.0102)	(0.0116)	(0.2146)	(0.0058)	(0.0300)	(0.0460)	(0.0635)
lEN	0.0169*	-0.0083***	-0.3452	0.0104*	-0.0417	-0.0945	-0.2842***
	(0.0089)	(0.0109)	(0.2624)	(0.0055)	(0.0368)	(0.0717)	(0.0266)
PCL	0.0305	-0.0922**	-1.648**	-0.0112	-0.1666	-0.1857	
	(0.0355)	(0.0375)	(0.7413)	(0.0189)	(0.1124)	(0.2772)	
TCR	-0.0280	-0.0439	-0.1684	-0.0255**	-0.0459		-0.0786
	(0.0241)	(0.0234) *	(0.2268)	(0.0118)	(0.0322)		(0.0889)
INF	0.0239**	-0.0065**	.0442	.0035	-0.0172	0.0409	0.0917
	(0.0105)	(0.0232)	(0.1582)	(0.0117)	(0.00248)	(0.0883)	(0.0544)
GDP	-0.0342	0.0717	-.1444	.0387*	-0.0491	0.2825	-0.2092
	(0.0361)	(0.0442)	(5064)	(0.0222)	(0.1109)	(0.2451)	(0.1703)
SHTI	0.0558	-0.5719	0.3882	-.0814	-0.0807	-2.966	-0.0625
	(0.2156)	(0.3925)	(3.459)	(0.1975)	(0.6773)	(2.004)	(0.5683)
SHTI2	-0.0083	0.0750*	0.1688	.0028	0.0372	0.3080	-0.0262
	(0.0216)	(0.0413)	(0.3404)	(0.0208)	(0.0612)	(0.1939)	(0.0455)
Number of Obs							

Where the dependent variables are: NIM is the Net Interest Margin, ROA and the ROE measured the profitability, Profit is the Total Profit, PM: is the Profit Margin, TCR is the Total Capital Ratio, PCL is the Credit Risk. The independent variables are: SIZE is the Bank size, CAP is the Capitalization, DIV is the Diversification, LEN is the Lending, GDP is the Real GDP Growth, INF is the Inflation rate, SHTI is the Short-term interest rate. Note: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 4. 22Empirical Dynamic Results of GMM Estimation of the impact of interest rate on Jordanian Commercial banks Profitability and Risk-taking (2003 -2015).

	(NIM)	(ROA)	(ROE)	(Profit)	(PM)	(TCR)	(PCL)
VARIABLES	GMM	GMM	GMM	GMM	GMM	GMM	GMM
L.NIM	-0.124						
	(0.264)						
SIZE	-1.507**	-2.277*	-6.154	0.302	-2.901**	1.079	-1.521
	(0.562)	(1.122)	(10.98)	(0.366)	(1.222)	(3.502)	(2.328)
CAP	0.0623*	0.238***	1.068**	0.0120	0.279***	1.206***	0.329**
	(0.0325)	(0.0519)	(0.428)	(0.0284)	(0.0563)	(0.268)	(0.119)
DIV	-0.0137	0.0598**	0.159	0.0045	0.0689**	0.0446	-0.110**
	(0.0100)	(0.0253)	(0.265)	(0.00490)	(0.0314)	(0.106)	(0.0389)
LEN	0.0086	-0.0405	-0.483	0.0062	-0.0482	-0.187	-0.304***
	(0.0167)	(0.0364)	(0.365)	(0.0142)	(0.0400)	(0.147)	(0.0205)
PCL	0.0320	-0.126	-1.718	0.0134	-0.141	-0.560	
	(0.0534)	(0.116)	(1.101)	(0.0410)	(0.127)	(0.436)	
TCR	-0.0097	-0.0515*	-0.372	-0.0001	-0.0545		-0.191**
	(0.0157)	(0.0271)	(0.241)	(0.0152)	(0.0309)		(0.0853)
INF	0.182**	-0.197*	-2.611**	-0.0277	-0.267**	0.473	0.387
	(0.0607)	(0.0929)	(0.994)	(0.0660)	(0.114)	(0.397)	(0.260)
GDP	0.199	-0.482**	-5.347***	-0.126	-0.639**	1.058	0.576
	(0.116)	(0.189)	(1.765)	(0.109)	(0.244)	(0.726)	(0.445)
SHTI	0.140	-0.430*	-1.302	0.226	-0.693*	-1.779	0.793
	(0.214)	(0.230)	(3.220)	(0.133)	(0.360)	(1.487)	(0.567)
SHTI2	-0.0021	0.0948***	0.249	-0.0195	0.140***	0.149	-0.0924
	(0.0230)	(0.0281)	(0.431)	(0.0163)	(0.0412)	(0.169)	(0.0700)
L.ROA		-0.361***					
		(0.0526)					
L.ROE			-0.131				
			(0.116)				
L.PROFIT				0.146			
				(0.187)			
L.PM					-0.311***		
					(0.0650)		
L.TCR						-0.0182	
						(0.145)	

L.PCL							-0.0611
							(0.0625)
Observations	49	49	49	49	49	44	47
Number of bank	13	13	13	13	13	11	12

Where the dependent variables are: NIM is the Net Interest Margin, ROA and the ROE measured the profitability, Profit is the Total Profit, PM: is the Profit Margin, TCR is the Total Capital Ratio, PCL is the Credit Risk. The independent variables are: SIZE is the Bank size, CAP is the Capitalization, DIV is the Diversification, LEN is the Lending, GDP is the Real GDP Growth, INF is the Inflation rate, SHTI is the Short-term interest rate. Note: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

4.5 Summary and conclusion

This chapter investigate the impact of competition, liquidity risk and market interest rate environment on the profitability of Jordanian banks' using data for 13 commercial banks for the period 2003-2015. The chapter attempts to answer the following four questions: (1) do competitive conditions affect the profitability of Jordanian banks? (2) does liquidity risk affect the profitability of Jordanian banks? (3) do interest rates affect the profitability of the Jordanian banks? And (4) which market type monopoly, monopolistic competition or perfect competition, best represents the Jordanian banking sector?

The analysis employed several econometric approaches to address the study questions and to ensure the robustness of the results. These methods include Pooled OLS, FE, RE, and GMM. We start our analysis by developing a Panzar-Rosse model for assessing the state of competition in the Jordanian banking sector (research question four). The results found that Jordanian commercial banks operate under monopolistic competition conditions. However, from 2004 onwards the concentration of the banking sector reduced slightly due to the entry of six new banks in 2004 and 2009 (Bank Audi, National Bank of Kuwait, Blom Bank, Jordan Dubai Islamic Bank, National Bank of Abu Dhabi and Al Rajhi Bank).

This chapter fills a gap in the empirical literature about the Jordanian banking sector by investigating the impact of competition, risk and interest rate on Jordanian commercial banks profitability. For assessing the reform policies implemented since the 1990s that were designed to improve banking sector profitability, competition, and stability, the second and third parts of the empirical analysis investigate the impact of competition, liquidity risk and the interest rate on a set of profitability and risk measures (How, and in what ways have the competitive conditions in affected the profitability of Jordanian banks?, Does liquidity risk

have an effect on the profitability of Jordanian banks?, To what extent have changes in interest rates affected the profitability of Jordanian banks?) utilizing a broad list of control variables that capture bank-specific, market structure and macroeconomic characteristics. Liquidity risk was found to have a significant positive impact on profitability, while bank's size, capital adequacy ratio, and equity to assets all reduced profitability measures. Interest yield is the main source of income for Jordanian banks and this corresponds to the positive relationship between net interest margin and profitability measures. The cost of funds and market concentration both have a significant negative impact on profitability measures. The negative effects of inflation on profitability reflect the inability of the banks to fully anticipate inflation and enhance their profits. Capitalization and size are the main risk determinants, wherein the former reduces risk while the latter encourages the risk-taking behaviour of the banks. The results support the favourable spillovers of the reform policies on the overall profitability and efficiency of the Jordanian banking sector which is clearly shown by the increasing number of banks which improving the competitiveness and it impacts on the bank performance, minimizing the concentration, decreasing the interest rate which encouraging lending that affecting investment activities positively. However, there is still a need to enhance market competition. The result also suggests that higher total banks' assets may not necessarily lead to higher profits. Careful management is required for the larger number of deposits and the acquired capital by Jordanian banks due to the inward migration of Iraqi and Syrian refugees to Jordan.

The positive change in the competitiveness state of the Jordanian banking sector corresponds to the entry of six new banks. The reported results are similar to the findings of (Demirguc-Kunt and Peria, 2010) who found a positive impact of competition on bank profitability. Our results confirm our hypothesis wherein liquidity risk has a significant positive impact. Our results are in line with (Bourke, 1989) who found evidence of a positive relationship between liquidity risk and bank profitability for 90 banks. The results suggest that short-term interest rate has no significant impact on profitability and risk measures. The result could be explained by the fact that the CBJ adopted low-interest-rate schemes during the reform phases, adversely affecting the banks' lending behavior and the volume of their interest yields. As a result, Jordanian banks started to use a wide range of products and services to improve banks' profitability and become less reliant on interest income. Interest yield is the main source of income for Jordanian banks and this corresponds to the positive relationship between net interest margin and profitability measures in line with (Bikker and

Hu, 2002).

CHAPTER 5

The Relationship between Bank Efficiency, Capital and Risk: Evidence from Jordan's Banking System

5.1 Introduction

The Jordanian economy is one of the smallest in the Middle East region, yet possessing one of the most developed and stable banking systems in the region. The Jordanian financial system may be described as bank-based financial system in which banks play a vital role in financial intermediation, transformation of savings into investments, allocation of scarce capital resources, risk sharing and risk diversification. Over time, the central bank of Jordan (CBJ) has initiated many reform measures that have been primarily focused on making the banking system more stable and competitive. As a direct consequence, banks in Jordan had no other option than to increase their capitalization which culminated in the growth of related banking activities and increased asset growth demand which, in turn, demanded more bank specific capital. Many studies in the literature have argued that growing competition only serves to force banks to engage in more risky activities in order to position themselves at the ahead of the market (Hellmann et al., 2000, Salas and Saurina 2003, and Goddard and Wilson 2009). While it has also been argued that capital adequacy requirements, despite its advantage, creates conditions whereby banks are induced to undertake more risk-taking behavior. In light of these issues, the purpose of this chapter is to examine whether there exists any relationship between bank efficiency/productivity, capital, and risk in the Jordanian banking system. The empirical analysis is based on the Three-Stage Least Square (3SLS) method which we use to estimate a system of equations that employ different risk indicators for a sample of 13 banks covering the period 2003-2015. In so doing, this chapter seeks to answer three main related questions. First, whether efficiency, production, and capital are affected by variation in banks' risk? Second, whether efficiency, productivity, and risk are affected by variations in bank capital? Third, whether capital levels combined with bank risk cause changes in bank efficiency and/or production? The importance of this study lies in evaluating the policy measures that have been enforced by the Central Bank of Jordan (CBJ) to liberalize the banking sector in the banks

attempts to improve bank efficiency[1] and, on the basis of the issues will be examined, fills an important gap in the literature on banking efficiency in developing countries by using the Jordanian data. In the literature, only a few studies have looked at the efficiency of the banking sector in developing countries using Middle East region data (Olson and Zoubi, 2003); (Hussain and Hassan, 2005); (Caporale et al., 2017). The majority of studies have shown a preference to investigate these dynamic relations using data for a selection of developed countries using various approaches. Examples include (Rime, 2001), (Konishi and Yasuda, 2004), (Stolz et al., 2004), and (Tan and Floros, 2013). Thus, the present study is an important addition to the existing body of studies reported in the literature since 2000. The rest of the chapter is organized as follows: Section 5.2 provides a brief review of the literature. Section 5.3 presents a historical overview of the impact of regulatory measures on the risk analysis of the Jordanian banking system. Section 5.4 presents the data and methodology. Section 5.5 presents the empirical results, and Section 5.6 provides the summary and conclusion.

5.2 Literature review

Since the 2008 financial crisis, more focus has been directed towards analyzing and improving the financial soundness of banking systems. The principal task of bank regulators has been on ensuring that banks are compliant with capital adequacy requirements. Capital adequacy measures the ratio of a bank's capital to bank risk-weighted credit exposures. This ratio reflects the level of capital buffer at the bank that can support lending policies and mitigate potential losses. Creating a sound balance between bank capital and risk has become one of the main objectives of banks globally post the 2008 financial crisis. This was given added emphasis by the Basel III requirements, which concentrated the minds of banks to maintain the quality of bank capital base and increase the capital requirements of bank risk-weighted assets.

In our review of the literature in Chapter five, several hypotheses were developed to

[1] CBJ has applied several reforms to enhance the banking sector, such as the new banking, securities, and auditing profession law. As a result, total deposits and credit facilities of licensed banks has increased, contributing to the growth of commercial banks in Jordan. the CBJ has also increased loan guarantees for small and medium and entrepreneurs through the restructuring of the Jordan Loan Guarantee Corporation, and has increased funds available to them through the provision of CBJ funding programmes in certain industries primarily in technology, media, telecommunications and the service sector, with other ventures in agribusiness, pharmaceuticals, water and green energy.

explain the relationship between bank risk, capital, and efficiency including the "bad management" hypothesis as stated by (Berger and DeYoung, 1997) and (Williams, 2004). According to their view, in-adequate monitoring and managing of credit and operations adversely affect efficiency and thus increase banks' risk. The second theory is the "bad luck" hypothesis. External exogenous shocks increase loan-related problems and do not directly affect operations' management and/or the bank risk-taking behavior (Berger and DeYoung, 1997). However, risk increases do require additional managerial efforts and costs. And so, we would expect bank efficiency to have a negative relationship with risk. The third theory is the "moral hazard" hypothesis, which suggests that managers of less-capitalized and low-efficient banks tend to engage in riskier investment decisions than usual (Jeitschko and Jeung, 2005). Based on this theory, we expect a negative relationship between bank risk and capital. The theory of capital structure states that a higher use of debt (equity) financing within a certain range, might actually reduce (increase) firms' cost of capital. Thus, a positive (negative) coefficient estimate for equity-to-assets indicates an efficient (inefficient) management of banks' capital structure. Besides, efficiency and competition between banks can influence the stability of the sector (Carletti and Hartmann, 2002). The link between competition and financial stability has been recognized in theoretical and empirical research. Indeed, competition affects the stability of the sector in the sense of either fragility or excessive risk-taking (Geraldine and Weill (2008). Balanced portfolio theory also plays a vital role in the study of the performance of the banks. (Nzongang and Atemnkeng,2006). This theory states that decisions regarding the policy affect the optimal presence of each asset in the investment of shareholder which affected by factors such as rate of return, size of the portfolio and risks associated with the holding of each asset. High profits can be achieved by a possible set of liabilities and assets which are recognized by management and expenses incurred by banks. Bank performance affected by risk-return trade-off and the equity to asset ratio. According to financing theory, high levels of debt and low value of equity to asset ratio results in high risk which results in high rates of return which also explains the risk-return trade-off theory (Van Ommeren, 2011). Some studies explained that higher profits can be fetched by high equity to asset ratio. The market value of the bank increases with high equity ratio according to the signalling hypothesis (Berger, 1995). On the other hand, bankruptcy cost hypothesis states that banks hold high equity as a result of unexpectedly high bankruptcy costs to avoid financial debt (Berger, 1995).

Many empirical studies have investigated the effects of regulation on banks' efficiency,

capital, and risk. In these respects, (Kwan et al., 1997) found that operational efficiency is affected by bank risk-taking behavior and they argued that banks with more capital operate more efficiently than banks with less capital. Several studies found that the incorrect design of capital requirements leads to excessive risk-taking behavior by banks (Yehuda and Kahane, 1977, Kim and Santomero, 1988, and Koehn and Santomero, 1980). While (Shrieves and Dahl, 1992) and (Jacques and Nigro, 1997) found that having the desired balance between level of capital and risk depends on exogenous factors such as regulation, level of liquid assets, economic cycle, size, and profitability. In addition, (Shrieves and Dahl, 1992), (Jacques and Nigro, 1997), and (Matejašák et al., 2009) all share the view that when the regulatory pressure increase, banks tend to adjust their capital ratio by increasing capital and decreasing their risk. However, (Stolz et al., 2004) and (Van Roy, 2005) have argued that regulatory pressures tend to increase banks' risk-taking behavior. In contrast, (Rob et al., 1999), (Godlewski, 2004), (Iwatsubo, 2007), and (Distinguin et al., 2013) note that changes in bank's capital and risk appear to be severely affected by the banks' ex-ante capital level. (Distinguin et al., 2013) along with (Hussain and Hassan, 2005) showed that when considering the quality of capital, results vary according to the banks' capital ratio, total regulatory capital, Tier-1 capital, or equity.

Using a panel of US commercial banks and BHC data between 1986 and 2008, (Jokipii and Milne, 2008) found a positive relationship between short term adjustments in banks' capital buffers and risk. They also showed that the adjustments of the relationship between capital and risk depend on the level of bank capitalization. On a related issue, (Eyssell and Arshadi, 1990) examined the wealth effects of risk-based capital requirement based on daily data for 27 banks with book asset levels ranging from $3.5billion to $155billion for the period 1986-1988 and found that at the time of the announcement of new risk-based capital regulations, the equity values of the largest publicly traded banks decreased, especially in banks with deficient capital ratios. (Cooper et al. 1991) examined the effects of risk-based capital requirements on the banking system using weekly data of large international banks in the U.S., U.K, Canada, and Japan for the period 1985-1989 and found mixed results for equity returns in Japanese banks due to uncertainty among investors regarding the new risk-adjusted capital rules that were imposed. But in response to news announcements, a significant decline was observed in the equity returns of banks in the U.S., Canada, and U.K., with the largest reported decline being for U.S. bank stocks.

(Ediz et al., 1998) examined the impact of risk-based capital requirements on banks' risk-taking behavior for a sample of U.K banks over the period 1989-1995. They utilized a

dynamic, multivariate panel regression models in which changes in capital ratios depend on the lagged level of the ratio, in addition to a set of control variables describing the nature of the banks' decision-making systems, financial efficiency, and regulatory pressures. They found that banks met capital requirements by raising new capital rather than by alternating the loan composition in assets portfolio and that capital regulation could be considered an effective tool in reinforcing the stability of banks without disrupting banks' choices of lending. They also note that capital requirements does seem to affect bank behavior in comparison with the influence of the banks' own internally generated capital targets.

Using simultaneous equation modeling developed by (Shrieves and Dahl, 1992), (Rime, 2001) examined the impact of regulatory capital requirements on bank risk-taking behavior for a sample of Swiss banks for the period 1989-1995. Instead of the multibank holding company and leverage ratio, the authors developed a composite index of PCAU and PCAA to represent the regulatory variable. They also used the ratio of capital to total assets (ROA), and the ratio of capital to risk-weighted assets (RWA). They found that regulatory pressure had a significant positive impact on the ratio of the bank capital to total assets, but no significant impact on banks' risk-taking behavior. They also found a significant positive relationship between changes in risk and changes in the ratio of capital to total assets is found. PCAU is also found to have a significant positive impact on RWA but no significant impact on risk, while PCAA has no significant impact on both RWA and risk. Their results suggest that banks having lower capital than the minimum regulatory capital requirements take actions to raise capital adequacy ratio. Their findings also show that regulatory pressure increases banks' capital without levying a significant effect on bank risk. For both alternative measures of capital (capital to risk-weighted assets and capital to total assets), they observed that bank size has a significant negative impact on capital and has a significant positive impact on risk.

An Example of empirical evidence from developing countries is found in the work of (Alkadamani, 2015) who used data covering 46 commercial banks from 4 Middle Eastern countries during the period 2004-2014 to explore the relationship between capital and risk decisions. The author found that regulatory pressures increase both banks' capital and the banks' risk-taking behavior and that there was a positive relationship between banks' profitability and capital. (Hussain and Hassan, 2005) empirically examined the impact of capital requirements on credit risk-taking using data from 11 developing countries and found that regulations had no effect on bank capital ratios.

Since the 2008 global financial crises, the CBJ has prioritized safety over profitability inside the Jordanian banking sector with less attention given to studying the impact of bank adopted safety measures on efficiency and productivity indicators of banks. This chapter takes up this issue by not only studying the relationships between bank efficiency/productivity, capital and risk using data for a sample of 13 Jordanian banks covering the period 2003-2015, on account of these issues, contributes directly to the literature.

5.3 Background on risk analysis, efficiency and bank regulations in Jordan

Jordanian banks have served as agents for the Jordanian government since the 1970s and 1980s. During these decades, the extensive involvement of the government in the banking sector has led to serious structural imbalances in the Jordanian banking and financial systems. For example, the rate of uncollectible loans of Jordanian banks' portfolios reached 30 percent by the end of the 1980s. During the 1990s and in response to both the (WB) and IMF economic adjustment programs, the Jordanian government took steps to liberalize the financial and banking systems which resulted in measures to minimizing government direct lending, the removal of interest rates restrictions, promoting bank mergers and acquisitions, reducing foreign exchanging transaction restrictions, and increasing capital adequacy requirements. As a result, total deposits and credit facilities of licensed banks increased, reflecting the growth of commercial banks in Jordan. This led the IMF to note that "by the sheer size of their balance sheet, commercial banks play the most significant role" in Jordan's financial sector.

Jordanian banks are also the main funding source for both public and private sectors, with a capital adequacy ratio of 21 percent, which is well above the prudential requirement of 12 percent. The CBJ's deregulation of the financial system brought with it deregulated interest rates and credit allocations, foreign bank entry, and modern supervisory controls (Bdour and Al-khoury, 2008). At the time, the imposition of these measures was seen as important as they meant that banking sector regulation, in particular, were broadly consistent with international norms. These regulations also affected bank payments, government securities transactions, loans, capital adequacy, risk-based provisioning, internal controls, liquidity management, and deposit insurance. More recently, CBJ supervision over Jordanian banks has intensified, as a result of the financial crisis, and has shifted from a risk-based approach to a rule-based approach. Within this new regulatory environment, banks have become subject to frequent inspections by the CBJ. And although this would seem to mark a turning point in the history

of the Jordanian banking system, only a few studies, such as (Maghyereh, 2008), have examined the impact of the recent reforms on Jordanian bank efficiency.

5.4 Empirical Approach

5.4.1 Data

This chapter examines the magnitude and direction of the dynamic relationships between bank efficiency/productivity, capital and risk for 13 Jordanian commercial banks in response to the imposed capital requirements during the period 2003-2015. Data are sourced from ASE, ABJ, and CBJ, and the commercial Jordanian bank's annual reports. Tables 5.1 present variables definitions and notations.

Table 5 1 Variables' definitions and sources

Variable	Notation	Measurement	Type	Source
Dependent Variables				
Risk	LLPTL	Loan-loss provision as a fraction to total loans	Bank-specific	Annual Reports
	VROA	Standard deviation of ROA		
	VROE	Standard deviation of ROE		
	Z-score	Ratio between a bank's return on assets plus equity capital/total assets and the standard deviation of the return on assets		
Efficiency	TE1,	Technical efficiency	Bank-specific	Annual Reports
	TE2,	Technological		
	TE3,	pure technical efficiency		
	TE4	scale efficiency		
	TE5	productivity		
Capital	CAP	Book value of capital to total assets	Bank-specific	Annual Reports
Independent variables				
Profitability	ROA	Return on Assets	Bank-specific	Annual Reports
Size	SIZE	Natural logarithm of total assets	Bank-specific	Annual Reports
Liquidity	Liquidity	Ratio of loan to total assets	Bank-specific	Annual Reports
Tax to pre-tax profit	Taxation	Ratio of tax to pre-tax profit	Bank-specific	Annual Reports
Non-traditional activity	OBSOTA	Ratio of off-balance-sheet items to total assets	Bank-specific	Annual Reports
Labor Productivity	LP	Ratio of gross total revenue to number of employees	Bank-specific	Annual Reports
Concentration	CO3	The ratio of large three banks in terms of total assets to the total assets of the banking industry	Industry	CBJ
Stock market development	SMD	Ratio of stock market capitalization over GDP	Industry	CBJ

Inflation Rate	INF	Annual inflation rate	Macro	CBJ
GDP Growth Rate	GDP	Annual GDP growth rate	Macro	CBJ

5.4.2 Descriptive statistics

Tables 5.2 report the variables' descriptive statistics. Risk measures (LLPTL, VROA, VROE, and Z-score) have mean values of 0.70, 0.61, 2.70, and 6.71 and standard deviations of 6.96, 1.34, 1.93 and 6.20 respectively. The mean value of bank TE1, TE2, TE3, TE4, and TE5 are 100.42, 102.33, 100.31, 100.15, and 102.75 with the standard deviation approaching 6.99, 9, 6.35, 4.62, and 10.74 respectively. Capital is, on average, 14.21 with a standard variation of 6.35. ROA is, on average, 1.43 with a standard variation of 0.71. Size is, on average, 9.14 with a standard variation of 0.49. The Liquidity mean is 43.83 with a standard deviation of 10.51. The taxation mean is 33.37 with a standard deviation of 45.33. The OBSOTA mean is 26.876 with a standard deviation of 27.09. The LP mean is 4.93 with a standard deviation of 0.28. The C3 mean is 68.81 with a standard deviation of 3.70. The SMD mean is 8.51 with a standard deviation of 20.12. The GDP mean is 4.74 with a standard variation of 2.47. The Inflation mean is 4.14 with a standard variation of 3.44.

Table 5 2Summary statistics (efficiency model)

VARIABLES	Obs	Mean	Std. Dev.	Min	Max
TE1	169	100.429	6.9908	82	147.6
TE2	169	102.337	9.0058	75.6	128.5
TE3	169	100.313	6.3561	74.1	144
TE4	169	100.153	4.6224	83.3	126.5
TE5	169	102.758	10.7452	75.6	145.5
LLPTL	166	.7004	6.9611	-83.91133	19.3130
VROA	169	.6111	1.3440	.0389872	12.6512
VROE	169	2.7062	1.9373	.3301969	10.6955
Zscor	169	6.7125	6.2032	-.3890879	30.9862
Cap	169	14.2102	6.3536	-31.35458	37.5247
ROA	169	1.4343	.7122	-1.01	4.97
Size	169	9.1438	.4973	7.824972	10.4126
Liquidity	169	43.8393	10.5195	.2785299	60.2789
Taxation	169	33.3723	45.3375	-36.23785	401.9836

OBSOTA	169	26.7696	27.0937	0	143.4858
LP	168	4.9373	.2847	3.324286	5.6586
C3	169	68.8130	3.7012	62.60214	76.0322
SMD	169	8.5143	20.1217	.203627	150.9594
GDP	169	4.7430	2.4796	2.3	8.53
INF	169	4.1469	3.4460	-.7	14

Note: statistics calculated using STATA 5.1.

5.4.3. Efficiency and risk models

Our empirical strategy draws on the insights of (Tan and Floros, 2013) and use the 3SLS simultaneous equations modelling to estimate the following models:

$$BRisk_{it} = \alpha_0 + \alpha_1 Cap_{it} + \alpha_2 \frac{Eff}{O_{it}} + \alpha_3 Bank_{it} + \alpha_4 Ind_{it} + \alpha_5 Mac_{it} + \nu_t \quad (5.1)$$

$$Cap_{it} = \beta_0 + \beta_1 \frac{Eff}{O_{it}} + \beta_2 Risk_{it} + \beta_3 Bank_{it} + \beta_4 Ind_{it} + \beta_5 Mac_{it} + \nu_{it} \quad (5.2)$$

$$\frac{Eff}{O_{it}} = \lambda_0 + \lambda_1 Cap_{it} + \lambda_2 Risk + \lambda_3 Bank_{it} + \lambda_4 Ind_{it} + \lambda_5 Mac_{it} + \nu_t \quad (5.3)$$

where the subscript *i* indicate cross-sectional dimension across banks, while *t* reflects the time dimension. RISK is the proxy for the bank's risk, CAP is the proxy for the bank's capital and measured by the equity to total assets ratio. EFF/PROD is the proxy for the bank's efficiency and measured using the Malmquist productivity index. Bank, Ind, and Mac are the bank-specific, industry-specific and macroeconomic factors that influence the efficiency/productivity–capital–risk relationship, ν_t is a random error term. The purpose of Model 5.1 is to examine whether efficiency and/or production and capital temporarily existed prior to any variation in banks' risk, while Model 5.2 looks at whether risk, efficiency and/or productivity temporarily existed before variations in bank capital and Model 5.3 assesses whether capital levels combined with bank risk influence changes in bank efficiency and/or production.

For measuring bank risk, we use four alternative measures – loan-loss provision as a

fraction of total loans ratio, volatility of ROA, as measured by the standard deviation of ROA, volatility of ROE, as measured by the standard deviation of ROE, and Z-Score, measured by the ratio between a bank's return on assets plus the equity capital/total assets and the standard deviation of the return on assets. Bank capital is measured as the value of capital to total assets. We use the Malmquist Productivity Index (MPI) to calculate efficiency (Eff/O). Malmquist productivity index uses input and output distance functions to measure changes in productivity. The index is calculated based on s-technology and is expressed as follows:

$$m_0^s(q_s, q_t, x_s, x_t) = \frac{d_0^s(q_t, qx_t)}{d_0^s(q_s, x_s)} \tag{5.4}$$

In this study, we use the non-parametric methods represented by the Malmquist index proposed by (Malmquist, 1953) and later developed by (Douglas et al., 1982). This index measures total factor productivity between two banks or one bank over time. We also measure technical efficiencies using the non-parametric method, DEA. DEA technique utilizes the number of variables (inputs and outputs) and not their prices and thus does not require any relationship between inputs and outputs. Using more than one form of inputs and outputs of the Decision-Making Unit (DMU) is one of the DEA advantages (Graham et al., 2005). Defining and selecting banks' inputs and outputs for the DEA method is based on one of three approaches, production approach, intermediation approach, and value-added approach. We also use the intermediation approach in the selection of inputs and outputs which defines the bank as an intermediary that transfers assets from surplus units to deficit units (Paul and Kourouche, 2008), (Alkhathlan and Malik, 2010). In calculating the index we use four inputs (number of full-time employees, total deposits, total assets, and interest expenses) and two outputs (loans and interest income) following (Varesi, 2015). Loans are considered one form of output from deposits (inputs) as noted by (Sealey and Lindley, 1977), (Lang and Welzel, 1996), and (Ashton and Pham, 2011). Table 5.3 shows the average DEA scores using the Malmquist index.

Table 5 3Average DEA efficiency scores using Malmquist index (2003-2015)

Year	Effch (TE1)	Techch (TE2)	Pech (TE3)	Sech (TE4)	Tfpch (TE5)
	Technical Efficiency	**Technological**	**Pure Technical Efficiency**	**Scale Efficiency**	**Total Factor Productivity**
2003	0.972	1.148	0.985	0.987	1.116
2004	0.984	1.089	0.967	1.017	1.071
2005	1.066	1.002	1.062	1.004	1.068
2006	0.972	1.015	0.985	0.987	0.987
2007	1.035	0.985	1.012	1.023	1.02
2008	0.988	1.088	0.987	1	1.075
2009	1.014	0.92	1.027	0.987	0.933
2010	0.996	1.022	0.993	1.003	1.017
2011	1.02	0.993	1.028	0.992	1.013
2012	0.981	1.05	0.976	1.005	1.03
2013	1.03	0.963	1.014	1.016	0.992
2014	0.994	0.993	1.006	0.989	0.987
2015	0.986	1.007	0.989	0.997	0.993
Average	1.003	1.02	1.002	1	1.022

Note: all Malmquist index averages are geometric means

As presented in Table 5.3 the geometric mean of the DEA test shows that the technical efficiency of the Jordanian commercial banks (2003-2015) is 1.003 percent, which is higher for Jordan than in other developing countries. For example, (Yildirim, 2010) estimated the technical efficiency of Turkish banks at a value of 89 percent. The index scores show that the deregulation and liberalization of Jordanian commercial banking contributed positively to the technical efficiency rates over the sample period. The improvement of average technical efficiency score implies that banks on average produce the same amount of outputs with fewer resources. The scores also highlight the negative impact of external shocks, such as the 2008 global financial crisis and the local economic downturns following the Arab spring in 2012–2015. The overall scores of the Malmquist index analysis also shows that Jordanian commercial banks benefited from deregulation and liberalization.

Our study utilizes a set of control variables (definitions appear in Table 5.1) that influence the relationship between efficiency, risk, and capital regulations. The set includes size, bank profitability, taxation, non-traditional banking activity (OBSOTA), labor (LP), industry-specific concentration (C3), market development (SMD), GDP growth, and inflation. Estimation results appear in Tables 5.4-5.8.

5.4.5 Empirical methodology

We estimate our models using the 3SLS structural equations method, which is widely used in the literature for estimating similar relationships, see, for example, (Tan and Floros, 2013) and (Rime, 2001). Since we suspect that endogeneity is an issue regarding the relationship between bank efficiency, risk, and capital, 3SLS is appropriate to solve this problem. 3SLS estimates systems of structural equations where some equations contain endogenous variables among the list of explanatory variables. These endogenous variables are then defined in the system as the dependent variables of the other equations in the system are independent variable in other equations. This method also enables us to define other endogenous variables other than the dependent variables.

Due to this endogeneity, the error disturbances of the equations become correlated with the endogenous variables, which in turn violate the assumptions of OLS. This method uses an instrumental-variables approach to present consistent and unbiased estimations. Also, it utilizes the method of generalized least squares (GLS) to account for the error terms serial correlation across the equations. This method incorporates three steps, in the first step instrumented values for all endogenous variables are developed by regressing each endogenous variable on all exogenous variables in the system. Then we obtain an estimate for the error covariance matrix of the equations during step two. The final step applies GLS-type estimation using the covariance matrix of stage two using the instrumented values of stage one as the right-hand side endogenous variables (Greene, 2012).

5.5 Results

This section presents the 3SLS empirical results for the Models 5.1-5.3. We use four measures for bank risk (Z-score, LLPTL, VROA, and VROE) and utilize Data Envelopment Analysis (DEA) in Table 5.5 to employ five efficiency types (technical, pure technical, technological, scale and total factor productivity).

All five efficiency measures reduce risk levels (mainly z-score and LLPTL). As improvement in efficiencies and reflects adequate monitoring and managing of credit and operations that translates into lower risk levels. Scale and technical efficiencies are the largest and most robust moderators of risk levels. As such, a one unit increase in scale efficiency reduces risk (z-score) by 1.44 units at the 95 percent confidence level as Table 5.7 shows.

Considering the control variables in the technical efficiency table, Table 5.6, ROA has a positive and statistically significant impact on banks' risk (z-score), capital and efficiency. Where for example, a one percent increase in ROA, increase risk, capital, and efficiency by 4.63 percent, 5.9 percent and 12.61 percent at the 99 percent confidence level. Similar to (Tan and Floros, 2013), banks with high profitability rates are better able to raise and manage their capital efficiently. Risk (all measures) has a negative impact on capital and efficiency, which supports our second sub-hypothesis that risk reduces operational efficiency. Size negatively affects risk in line with (Anderson and Fraser, 2000). As larger banks are better able to mobilize resources and mitigate potential losses of financial crises and economic downturns.

Liquidity only modestly improves technical efficiency, where one percentage increase in liquidity foster bank efficiency only by 0.42 percent at the 95 percent confidence level. However, when using LLPTL risk measure, liquidity tends to reduce efficiency by 1.72 percent. Liquidity has a positive impact on the level of capitalization of Jordanian banks. While liquidity reduces banks' risk in line with (Rahman et al., 2015). Others like (Kochubey and Kowalczyk, 2014) found a similar relationship indicating that banks tend to increase their liquidity following a decline in the capital ratio. Also, (Altunbas et al., 2007) found a significantly negative relationship between liquidity and the risk level. The high level of liquidity ratio based on the CBJ regulations reached 150 percent, which directly contributes to minimizing banks' risk and protects them from financial and macroeconomic shocks.

Off-balance sheet activities and taxation increase both banks' risk (LLPTL) and capital. Regarding the former, the results show that undertaking these activities helps to increase capital and profits however with the cost of higher risks. Regarding taxation, the tax ratio in Jordan is very high amounting to 35 percent. Higher taxation paid by banks reduces bank capital and consequently adversely affects the managers' incentives and efforts to control costs and this entails higher risk exposure levels. The results also show that capital reduces risk levels following our sub-hypothesis. It acts as a moderator factor for potential losses.

Table 5.5 reports the results of the relationship between bank capital, technological efficiency, and risk in Jordanian banking. The results show that most of the variables are consistent compared with the findings in Table 5.4. But unlike the technical efficiency results, capital tends to increase risk and reduce efficiency when using VROA as a risk measure. Since the Jordanian banking market, according to (AL-Qaisi, 2018), is highly concentrated and operates under monopolistic competition, high levels of capital in such markets lead to a

decline in bank efficiency (Tan and Floros, 2013). Stock Market Development (SMD) has a positive impact on bank capital and pure technical efficiency, as it reduces risk (VROA and VROE) as shown in Table 5.6. The improvement in the Jordanian stock market, especially in stock pricing, trade size transparency, and volume, provides reliable information for the investors that help in decreasing wrong investment choices.

Similar results are observed for pure technical, scale, and total factor productivity efficiency tables 5.6, 5.7, and 5.8. However, the negative impact of the concentration ratio (C3) on risk, capital, pure technical efficiency, and scale efficiencies become statistically significant as shown in Tables 5.6-5.7. Less competitive and concentrated bank markets lead to a decline in banks' operational efficiencies. Additionally, labor (LP) has a positive and statistically significant robust impact on risk and capital in Tables 5.6-5.8. A one percentage increase in labor increases risk and capital with 2.99 percent, and 19.24 percent respectively. The argument is that hiring highly productive labors require higher salaries, which in turn raise the need for a larger capital buffer to cover their expenses. This, in turn, increases the cost of input and the banks' risk exposure in times of financial shocks. Regarding the macroeconomic indicators, inflation has a positive and robust effect on all efficiency measures. During inflationary periods in 2008, the number of depositors decreases because of the erosion on the value of money, forcing bank managers to contribute more efforts to increase bank productivity.

Table 5 4Three-stage least square estimation for the relationship between bank capital, technical efficiency and risk-taking in the Jordanian banking system.

	Model where risk = Z-score			Model where risk = LLPTL		
	Eq. (1) Y = Z-score	**Eq. (2) Y = capital**	**Eq. (3) Y = efficiency**	**Eq. (1) Y = LLPTL**	**Eq. (2) Y = capital**	**Eq. (3) Y = efficiency**
Risk		-1.103*** (0.0554)	-2.719*** (0.111)		-5.078*** (0.863)	-13.18*** (2.072)
CAP	-0.906*** (0.0455)		-2.464***(0.0911)	-0.197*** (0.0326)		-2.595*** (0.275)
TE1	-0.368*** (0.0150)	-0.406*** (0.0150)		-0.0759*** (0.0114)	-0.385*** (0.0399)	
SIZE	-7.204** (2.966)	-7.949** (3.240)	-19.59** (8.026)	-2.486*** (0.733)	-12.62*** (3.424)	-32.75*** (9.332)
Liquidity	0.158** (0.0800)	0.174** (0.0883)	0.429** (0.218)	-0.131*** (0.0185)	-0.664*** (0.158)	-1.723*** (0.388)
Taxation	0.0194 (0.0138)	0.0214 (0.0152)	0.0527 (0.0375)	0.0113*** (0.00318)	0.0573*** (0.0171)	0.149*** (0.0450)
OBSOTA	-0.0312 (0.0447)	-0.0344 (0.0494)	-0.0848 (0.122)	0.0220** (0.0105)	0.112** (0.0535)	0.289** (0.140)
SMD	0.198** (0.0911)	0.218** (0.101)	0.538** (0.248)	-0.0119 (0.0209)	-0.0606 (0.108)	-0.157 (0.279)
LP	-0.394 (5.230)	-0.435 (5.772)	-1.072 (14.22)	3.167*** (1.213)	16.08** (6.402)	41.73** (16.55)
ROA	4.637*** (1.261)	5.116*** (1.404)	12.61*** (3.450)	-0.258 (0.290)	-1.309 (1.521)	-3.397 (3.922)
CO3	-0.770** (0.363)	-0.850** (0.402)	-2.094** (0.989)	0.0310 (0.0832)	0.157 (0.427)	0.408 (1.104)
GDP	-1.104** (0.505)	-1.218** (0.558)	-3.001** (1.376)	-0.204* (0.116)	-1.034* (0.596)	-2.683* (1.555)
INF	0.0933 (0.204)	0.103 (0.225)	0.254 (0.554)	0.0331 (0.0475)	0.168 (0.242)	0.436 (0.629)
Const.	167.5*** (41.57)	184.8*** (45.64)	455.4*** (112.7)	22.98** (10.22)	116.7** (47.95)	302.8** (127.0)
Obs.	131	131	131	129	129	129
chi2	644.40***	774.07***	1133.22***	142.59***	113.36***	109.51***
	Model where risk = VROA			**Model where risk = VROE**		
	Eq. (1) Y = VOA	**Eq. (2) Y = capital**	**Eq. (3) Y = efficiency**	**Eq. (1) Y = VOE**	**Eq. (2) Y = capital**	**Eq. (3) Y = efficiency**
Risk		73.67** (36.08)	129.1*** (23.53)		5.272*** (2.004)	6.972 (9.434)
CAP	0.0136*** (0.0051)		-1.752*** (0.484)	0.169*** (0.0639)		-1.802 (1.255)
TE1	0.00775***(0.0013)	-0.571*** (0.190)		0.0693 (0.0477)	-0.461** (0.201)	
SIZE	-0.257** (0.120)	18.89 (15.99)	33.11* (18.32)	0.833 (0.772)	-5.348* (2.950)	-11.36 (9.079)
Liquidity	-0.0114***(0.0030)	0.842* (0.432)	1.475*** (0.446)	-0.0600*** (0.0144)	0.327*** (0.115)	0.478 (0.517)
Taxation	-0.000625(0.0005)	0.0460 (0.0398)	0.0807 (0.0669)	-0.00390 (0.0026)	0.0220* (0.0124)	0.0356 (0.0396)
OBSOTA	0.00216 (0.0016)	-0.159 (0.158)	-0.279 (0.228)	-0.00502 (0.0080)	0.0315 (0.0395)	0.0641 (0.0760)
SMD	-0.00671* (0.0034)	0.494 (0.316)	0.866* (0.453)	-0.0349** (0.0165)	0.191** (0.0905)	0.286 (0.331)
LP	0.775*** (0.196)	-57.10* (33.64)	-100.0*** (32.85)	2.313** (0.946)	-11.43 (8.098)	-11.82 (27.91)
ROA	-0.0896* (0.0474)	6.602 (4.336)	11.57* (6.230)	0.134 (0.228)	-0.524 (1.343)	0.0915 (3.135)
CO3	0.0181 (0.0136)	-1.332 (1.107)	-2.334 (1.766)	0.246*** (0.0645)	-1.338*** (0.491)	-1.948 (2.153)
GDP	0.0798*** (0.0189)	-5.882* (3.047)	-10.31*** (2.980)	0.175** (0.0891)	-0.925* (0.530)	-1.259 (1.846)
INF	-0.0154** (0.0076)	1.133 (0.777)	1.984* (1.044)	-0.0431 (0.0358)	0.213 (0.210)	0.227 (0.594)
Const.	-2.913* (1.638)	214.7* (123.1)	376.0* (202.3)	-40.42*** (10.84)	231.2*** (52.41)	383.5 (284.1)
Obs.	131	131	131	131	131	131
chi2	146.65***	13.06	75.16***	101.09***	40.27***	4.77

Where the dependent variables are: LLPTL, VROA, VROE and Z-score are the Risk measurements, TE1, TE2, TE3, TE4, TE5 are the Efficiency measurments, CAP is the Capital. The independent variables are: ROA is the Profitability, SIZE is the Bank Size, Liquidity is the Loan to total assets, Taxation is the Tax to pre-tax profit, OBSOTA is the Non-traditional activity, LP is the Labor Productivity, CO3 is the Concentration, SMD is the Stock market development, INF is the Inflation, GDP is the GDP growth. Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 5 5Three-stage least square estimation for the relationship between bank capital, technological efficiency and risk-taking in the Jordanian banking system.

	Model where risk = Z-score			Model where risk = LLPTL		
	Eq. (1) Y = Z-score	**Eq. (2) Y = capital**	**Eq. (3) Y = efficiency**	**Eq. (1) Y = LLPTL**	**Eq. (2) Y = capital**	**Eq. (3) Y = efficiency**
Risk		-0.601 (1.579)	3.308*** (0.498)		-3.430 (3.185)	11.23** (4.876)
CAP	-0.380 (0.523)		1.038 (1.813)	-0.153 (0.117)		1.028 (1.822)
TE2	0.291*** (0.041)	0.0409 (0.453)		0.0709***(0.0212)	0.0925 (0.217)	
SIZE	-2.288 (5.402)	-8.773*** (2.898)	5.475 (18.54)	-2.076 (1.274)	-11.76*** (3.016)	16.57 (20.28)
Liquidity	0.106 (0.0694)	0.122 (0.136)	-0.335 (0.241)	-0.137***(0.0192)	-0.430 (0.479)	1.598** (0.713)
Taxation	0.0131 (0.0151)	0.0240** (0.0121)	-0.0388 (0.0518)	0.0115***(0.0037)	0.0488* (0.0277)	-0.115 (0.0729)
OBSOTA	-0.0462 (0.0400)	0.00283 (0.106)	0.162 (0.137)	0.0218* (0.0112)	0.0952* (0.0548)	-0.215 (0.173)
SMD	0.123 (0.0868)	0.173 (0.149)	-0.378 (0.305)	-0.0216 (0.0226)	-0.00679 (0.131)	0.339 (0.299)
LP	-4.457 (4.417)	0.986 (10.25)	15.78 (14.94)	2.621** (1.180)	11.02 (7.827)	-26.50 (19.86)
ROA	3.283*** (1.073)	3.040 (4.701)	10.56** (4.107)	-0.490* (0.296)	-0.862 (2.199)	6.668 (4.156)
CO3	-0.738** (0.310)	-0.614 (0.992)	2.392** (1.091)	0.0106 (0.0840)	-0.0332 (0.376)	-0.228 (1.102)
GDP	-0.800* (0.434)	-0.930 (1.093)	2.519 (1.553)	-0.158 (0.119)	-0.880 (0.543)	1.301 (1.815)
INF	-0.115 (0.158)	0.112 (0.282)	0.432 (0.520)	-0.0164 (0.0491)	0.128 (0.219)	0.439 (0.604)
Const.	71.11 (58.63)	124.2* (63.99)	-212.2 (205.4)	8.574 (14.59)	85.37** (37.10)	-15.84 (206.2)
Obs.	131	131	131	129	129	129
chi2	101.25***	41.61***	49.48***	128.99***	35.46***	10.03
	Model where risk = VROA			**Model where risk = VROE**		
	Eq. (1) Y = VOA	**Eq. (2) Y = capital**	**Eq. (3) Y = efficiency**	**Eq. (1) Y = VOE**	**Eq. (2) Y = capital**	**Eq. (3) Y = efficiency**
Risk		20.93*** (2.995)	138.7*** (50.37)		6.385** (3.162)	-19.30** (8.181)
CAP	0.0478***(0.0067)		-6.631*** (1.855)	0.144** (0.0596)		2.544 (2.047)
TE2	0.00720***(0.0016)	-0.151***(0.0272)		-0.0475***(0.0137)	0.266 (0.183)	
SIZE	0.278* (0.151)	-5.828** (2.928)	-38.66* (21.69)	0.608 (0.749)	-4.691 (3.901)	9.529 (18.73)
Liquidity	-0.00941**(0.0040)	0.197** (0.0858)	1.306* (0.695)	-0.0557***(0.0140)	0.362** (0.166)	1.058* (0.558)
Taxation	-0.0009(0.0007)	0.0201 (0.0146)	0.133 (0.104)	-0.00429 (0.0026)	0.0290* (0.0150)	-0.0782 (0.0681)
OBSOTA	0.0018 (0.0021)	-0.0388 (0.0468)	-0.257 (0.327)	-0.00528 (0.0078)	0.0363 (0.0476)	-0.0944 (0.169)
SMD	-0.0115** (0.0045)	0.241** (0.0947)	1.596** (0.767)	-0.0296* (0.0167)	0.202* (0.109)	-0.536 (0.467)
LP				2.741*** (0.910)	-17.06 (11.94)	54.07* (27.81)
ROA	-0.0649 (0.0598)	1.360 (1.226)	9.019 (8.290)	0.297 (0.222)	-1.741 (1.923)	6.130 (4.750)
CO3	0.0158 (0.0201)	-0.331 (0.421)	-2.194 (2.879)	0.259*** (0.0633)	-1.661** (0.765)	4.976** (2.374)
GDP	0.0999*** (0.0250)	-2.090*** (0.551)	-13.85** (5.508)	0.156* (0.0894)	-1.061* (0.631)	2.837 (2.483)
INF	-0.0253** (0.0104)	0.529** (0.220)	3.506** (1.680)	-0.0164 (0.0367)	0.144 (0.251)	-0.225 (0.852)
Const.	-4.411** (2.108)	92.34** (41.35)	612.4** (306.4)	-29.73*** (9.071)	199.8*** (68.36)	-547.2 (349.1)
Obs.	125	125	125	131	131	131
chi2	88.24***	122.40***	14.34	117.17***	21.77**	8.55

Where the dependent variables are: LLPTL, VROA, VROE and Z-score are the Risk measurements, TE1, TE2, TE3, TE4, TE5 are the Efficiency measurments, CAP is the Capital. The independent variables are: ROA is the Profitability, SIZE is the Bank Size, Liquidity is the Loan to total assets, Taxation is the Tax to pre-tax profit, OBSOTA is the Non-traditional activity, LP is the Labor Productivity, CO3 is the Concentration, SMD is the Stock market development, INF is the Inflation, GDP is the GDP growth. Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 5 6Three-stage least square estimation for the relationship between bank capital, pure technical efficiency and risk-taking in the Jordanian banking system.

	Model where risk = Z-score			**Model where risk = LLPTL**		
	Eq. (1) Y = Z-score	**Eq. (2) Y = capital**	**Eq. (3) Y = efficiency**	**Eq. (1) Y = LLPTL**	**Eq. (2) Y = capital**	**Eq. (3) Y = efficiency**
Risk		-1.461*** (0.135)	-2.917*** (0.144)		-6.422*** (1.050)	-14.37*** (1.502)
CAP	-0.684*** (0.0627)		-1.996*** (0.175)	-0.156*** (0.0244)		-2.237*** (0.315)
TE3	-0.343*** (0.0167)	-0.501*** (0.0439)		-0.0696***(0.00691)	-0.447*** (0.0624)	
SIZE	-5.436** (2.664)	-7.943** (3.796)	-15.86** (7.747)	-2.164*** (0.661)	-13.90*** (4.029)	-31.09*** (9.480)
Liquidity	0.119* (0.0708)	0.173* (0.104)	0.346* (0.207)	-0.138*** (0.0171)	-0.889*** (0.192)	-1.989*** (0.328)
Taxation	0.0156 (0.0122)	0.0227 (0.0178)	0.0454 (0.0357)	0.0106***(0.00294)	0.0680*** (0.0202)	0.152***(0.0440)
OBSOTA	-0.0436 (0.0396)	-0.0637 (0.0586)	-0.127 (0.116)	0.0197** (0.00969)	0.126** (0.0628)	0.282** (0.140)
SMD	0.184** (0.0807)	0.269** (0.119)	0.538** (0.236)	-0.0142 (0.0193)	-0.0913 (0.127)	-0.204 (0.280)
LP	-1.285 (4.631)	-1.877 (6.780)	-3.747 (13.51)	2.997*** (1.122)	19.24** (7.573)	43.05*** (16.45)
ROA	4.691*** (1.117)	6.854*** (1.710)	13.68*** (3.298)	-0.241 (0.268)	-1.548 (1.776)	-3.464 (3.906)
CO3	-0.640** (0.322)	-0.936** (0.473)	-1.868** (0.941)	0.0547 (0.0770)	0.351 (0.503)	0.785 (1.112)
GDP	-1.182*** (0.447)	-1.726*** (0.662)	-3.446*** (1.311)	-0.218** (0.107)	-1.399** (0.703)	-3.130** (1.560)
INF	0.0667 (0.180)	0.0974 (0.263)	0.194 (0.526)	0.0258 (0.0441)	0.166 (0.283)	0.371 (0.635)
Const.	143.8*** (37.06)	210.0*** (54.20)	419.3*** (108.2)	18.53** (9.170)	119.0** (56.31)	266.2** (129.5)
chi2	131	131	131	129	129	129
chi2	471.64***	147.23***	469.45***	216.96***	64.11***	122.52***
	Model where risk = VROA			**Model where risk = VROE**		
	Eq. (1) Y = VOA	**Eq. (2) Y = capital**	**Eq. (3) Y = efficiency**	**Eq. (1) Y = VOE**	**Eq. (2) Y = capital**	**Eq. (3) Y = efficiency**
Risk		56.90 (55.87)	135.0*** (20.28)		5.668*** (1.834)	4.872 (7.219)
CAP	0.0174** (0.0080)		-2.356** (1.012)	0.167*** (0.0522)		-1.176 (1.047)
TE3	0.00741***(0.0010)	-0.422 (0.348)		0.0803 (0.0497)	-0.543** (0.255)	
SIZE	-0.213 (0.131)	12.02 (21.98)	28.68 (19.49)	0.882 (0.696)	-5.514* (3.010)	-7.896 (7.309)
Liquidity	-0.0112***(0.0029)	0.639 (0.582)	1.515*** (0.444)	-0.0549***(0.0139)	0.312*** (0.112)	0.271 (0.400)
Taxation	-0.0007(0.0005)	0.0416 (0.0345)	0.0985 (0.0710)	-0.00393 (0.0025)	0.0227* (0.0129)	0.0223 (0.0312)
OBSOTA	0.0020 (0.0016)	-0.115 (0.181)	-0.275 (0.232)	-0.00441 (0.0077)	0.0269 (0.0413)	0.0348 (0.0554)
SMD	-0.0073**(0.0034)	0.418 (0.359)	0.991** (0.469)	-0.0363** (0.0161)	0.210** (0.0915)	0.203 (0.258)
LP	0.756*** (0.194)	-42.97 (48.05)	-102.0*** (31.62)	2.251** (0.920)	-12.22 (7.773)	-7.232 (20.86)
ROA	-0.100** (0.0467)	5.708 (5.080)	13.52** (6.386)	0.0561 (0.233)	-0.123 (1.408)	1.086 (2.253)
CO3	0.0180 (0.0135)	-1.029 (1.022)	-2.437 (1.820)	0.233*** (0.0625)	-1.327*** (0.481)	-1.187 (1.664)
GDP	0.0853*** (0.0187)	-4.854 (4.450)	-11.51*** (2.924)	0.207** (0.0869)	-1.200** (0.522)	-1.187 (1.426)
INF	-0.0155** (0.00745)	0.881 (0.914)	2.089** (1.050)	-0.0370 (0.0367)	0.189 (0.219)	0.0377 (0.449)
Const.	-3.249* (1.698)	185.6 (115.9)	438.8** (223.7)	-41.03*** (9.661)	244.5*** (53.98)	283.3 (224.9)
Obs.	131	131	131	131	131	131
chi2	169.73***	6.28	55.75***	107.06***	38.35***	7.98

Where the dependent variables are: LLPTL, VROA, VROE and Z-score are the Risk measurements, TE1, TE2, TE3, TE4, TE5 are the Efficiency measurments, CAP is the Capital. The independent variables are: ROA is the Profitability, SIZE is the Bank Size, Liquidity is the Loan to total assets, Taxation is the Tax to pre-tax profit, OBSOTA is the Non-traditional activity, LP is the Labor Productivity, CO3 is the Concentration, SMD is the Stock market development, INF is the Inflation, GDP is the GDP growth. Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 5 7Three-stage least square estimation for the relationship between bank capital, scale efficiency and risk-taking in Jordanian banking system.

	Model where risk = Z-score			Model where risk = LLPTL		
	Eq. (1) Y = Z-score	**Eq. (2) Y = capital**	**Eq. (3) Y = efficiency**	**Eq. (1) Y = LLPTL**	**Eq. (2) Y = capital**	**Eq. (3) Y = efficiency**
Risk		-0.717*** (0.224)	-0.688** (0.284)		-3.393 (2.674)	-2.620 (2.943)
CAP	-1.390*** (0.480)		-0.961*** (0.173)	-0.237 (0.208)		-0.843*** (0.276)
TE4	-1.442** (0.645)	-1.040*** (0.183)		-0.233 (0.294)	-1.138*** (0.350)	
SIZE	-10.98* (5.726)	-7.902*** (2.846)	-7.594** (3.105)	-2.736 (1.925)	-10.88*** (3.268)	-8.985* (4.598)
Liquidity	0.249** (0.124)	0.179** (0.0791)	0.172** (0.0812)	-0.120***(0.0329)	-0.378 (0.408)	-0.282 (0.432)
Taxation	0.0306 (0.0207)	0.0220* (0.0133)	0.0211 (0.0135)	0.0125**(0.0051)	0.0459* (0.0245)	0.0367 (0.0285)
OBSOTA	-0.0123 (0.0634)	-0.00872 (0.0461)	-0.00830 (0.0450)	0.0224 (0.0138)	0.0836 (0.0532)	0.0673 (0.0573)
SMD	0.229* (0.128)	0.165* (0.0923)	0.158 (0.0969)	-0.00967 (0.0267)	-0.0204 (0.113)	-0.0112 (0.106)
LP	2.746 (7.606)	1.991 (5.224)	1.920 (5.029)	3.537** (1.803)	13.45* (7.467)	10.90 (8.163)
ROA	3.575** (1.716)	2.563* (1.476)	2.458 (1.602)	-0.495 (0.335)	-1.805 (1.791)	-1.436 (1.764)
CO3	-0.972* (0.519)	-0.698* (0.365)	-0.670* (0.378)	0.0156 (0.111)	-0.0191 (0.426)	-0.0407 (0.392)
GDP	-1.056 (0.685)	-0.757 (0.534)	-0.726 (0.557)	-0.195 (0.129)	-0.663 (0.629)	-0.513 (0.649)
INF	0.249 (0.278)	0.179 (0.198)	0.172 (0.194)	0.0626 (0.0576)	0.246 (0.206)	0.201 (0.198)
Const.	310.2*** (113.3)	223.3*** (43.02)	214.6*** (47.37)	40.41 (44.20)	185.4*** (49.56)	160.3*** (41.87)
Obs.	131	131	131	129	129	129
chi2	23.03**	82.53***	33.27***	93.30***	39.39***	11.36
	Model where risk = VOA			**Model where risk = VROE**		
	Eq. (1) Y = VROA	**Eq. (2) Y = capital**	**Eq. (3) Y = efficiency**	**Eq. (1) Y = VOE**	**Eq. (2) Y = capital**	**Eq. (3) Y = efficiency**
Risk		42.45* (21.83)	31.14** (13.53)		4.137*** (1.087)	5.180** (2.284)
CAP	0.0235**(0.0113)		-0.734*** (0.0965)	0.242*** (0.0648)		-1.253*** (0.259)
TE4	0.0321** (0.0135)	-1.363*** (0.186)		0.193** (0.0836)	-0.798*** (0.159)	
SIZE	-0.180 (0.161)	7.646 (9.975)	5.611 (6.836)	1.423 (0.870)	-5.894** (2.847)	-7.384** (3.683)
Liquidity	-0.0134***(0.0037)	0.569** (0.272)	0.418** (0.173)	-0.0722***(0.0200)	0.299*** (0.0874)	0.374** (0.153)
Taxation	-0.0008 (0.0006)	0.0362 (0.0268)	0.0265 (0.0193)	-0.00576*(0.0033)	0.0239* (0.0130)	0.0299* (0.0179)
OBSOTA	0.0017 (0.0020)	-0.0754 (0.102)	-0.0553 (0.0722)	-0.00785 (0.0105)	0.0325 (0.0420)	0.0407 (0.0530)
SMD	-0.0073*(0.0040)	0.310 (0.206)	0.227 (0.143)	-0.0409* (0.0212)	0.169* (0.0889)	0.212* (0.129)
LP	0.707*** (0.237)	-30.02 (20.92)	-22.03 (13.74)	1.922 (1.251)	-7.949 (6.152)	-9.947 (8.942)
ROA	-0.0654 (0.0550)	2.778 (2.726)	2.038 (1.930)	0.282 (0.288)	-1.166 (1.224)	-1.460 (1.600)
CO3	0.0223 (0.0163)	-0.949 (0.731)	-0.696 (0.519)	0.274*** (0.0859)	-1.134*** (0.394)	-1.420** (0.659)
GDP	0.0782*** (0.0220)	-3.321* (1.900)	-2.436** (1.236)	0.181 (0.115)	-0.748 (0.506)	-0.936 (0.718)
INF	-0.0187**(0.0089)	0.792 (0.516)	0.581* (0.349)	-0.0694 (0.0467)	0.287 (0.197)	0.360 (0.270)
Const.	-6.049** (2.857)	256.9*** (83.12)	188.5*** (57.20)	-58.59*** (16.19)	242.6*** (41.43)	303.8*** (81.33)
Obs.	131	131	131	131	131	131
chi2	86.30***	68.78***	91.05***	71.63***	143.98***	41.06***

Where the dependent variables are: LLPTL, VROA, VROE and Z-score are the Risk measurements, TE1, TE2, TE3, TE4, TE5 are the Efficiency measurments, CAP is the Capital. The independent variables are: ROA is the Profitability, SIZE is the Bank Size, Liquidity is the Loan to total assets, Taxation is the Tax to pre-tax profit, OBSOTA is the Non-traditional activity, LP is the Labor Productivity, CO3 is the Concentration, SMD is the Stock market development, INF is the Inflation, GDP is the GDP growth. Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 5 8Three-stage least square estimation for the relationship between bank capital, total factor productivity and risk-taking in Jordanian banking system.

	Model where risk = Z-score			**Model where risk = LLPTL**		
	Eq. (1) Y = Z-score	**Eq. (2) Y = capital**	**Eq. (3) Y = efficiency**	**Eq. (1) Y = LLPTL**	**Eq. (2) Y = capital**	**Eq. (3) Y = efficiency**
Risk		-0.0435 (0.624)	0.407 (1.724)		-2.593 (2.300)	-6.299 (8.017)
CAP	-0.103 (1.247)		-2.713*** (0.714)	-0.261 (0.246)		-2.788*** (0.742)
TE5	0.135 (0.414)	-0.335*** (0.0861)		-0.0745 (0.0962)	-0.344*** (0.0826)	
SIZE	0.160 (11.99)	-9.407*** (2.187)	-26.12*** (8.718)	-3.143 (2.435)	-11.24*** (2.567)	-30.72** (12.19)
Liquidity	0.0838 (0.120)	0.0890 (0.0752)	0.202 (0.222)	-0.125***(0.0290)	-0.291 (0.347)	-0.673 (1.176)
Taxation	0.00767(0.0238)	0.0167* (0.0100)	0.0422 (0.0320)	0.0122**(0.0050)	0.0364* (0.0207)	0.0936 (0.0766)
OBSOTA	-0.0637(0.0552)	0.0309 (0.0548)	0.119 (0.150)	0.0230 (0.0141)	0.0714* (0.0430)	0.187 (0.151)
SMD	0.119 (0.174)	0.137 (0.0967)	0.317 (0.292)	0.00356 (0.0375)	0.0539 (0.0940)	0.180 (0.280)
LP	-5.813 (8.518)	6.053 (5.124)	19.82 (13.71)	3.565* (1.826)	11.31* (6.154)	29.74 (21.76)
ROA	3.162 (2.534)	2.110 (2.272)	4.172 (6.569)	-0.0362 (0.585)	0.674 (1.575)	2.480 (4.705)
CO3	-0.566* (0.342)	-0.151 (0.394)	-0.120 (1.117)	0.0564 (0.0888)	0.128 (0.336)	0.289 (1.027)
GDP	-0.856 (0.805)	-0.627 (0.643)	-1.284 (1.874)	-0.299 (0.187)	-0.991** (0.486)	-2.645 (1.713)
INF	0.0356 (0.370)	0.286* (0.161)	0.772* (0.444)	0.103 (0.0944)	0.393** (0.164)	1.093** (0.512)
Const.	56.59 (133.9)	108.0** (42.56)	269.2* (146.2)	25.55 (28.44)	102.9*** (30.25)	290.4*** (108.6)
Obs.	131	131	131	129	129	129
chi2	50.11**	55.82***	24.03**	105.54***	63.60***	22.59**
	Model where risk = VOA			**Model where risk = VROE**		
	Eq. (1) Y = VROA	**Eq. (2) Y = capital**	**Eq. (3) Y = efficiency**	**Eq. (1) Y = VOE**	**Eq. (2) Y = capital**	**Eq. (3) Y = efficiency**
Risk		-21.36 (30.20)	-65.33 (83.51)		8.597 (7.054)	-22.25*** (6.645)
CAP	-0.0384 (0.0479)		-3.004*** (0.422)	0.112 (0.0749)		2.466 (2.267)
TE5	-0.0129 (0.0149)	-0.333*** (0.0475)		-0.0445***(0.0128)	0.373 (0.410)	
SIZE	-0.743 (0.466)	-17.58 (11.72)	-53.25* (31.85)	1.196 (0.832)	-10.59** (4.438)	26.32 (23.98)
Liquidity	-0.0069(0.00496)	-0.133 (0.315)	-0.411 (0.882)	-0.0366**(0.0159)	0.318 (0.225)	-0.811* (0.485)
Taxation	0.0002(0.000978)	0.0079 (0.0167)	0.0234 (0.0496)	-0.0021(0.0030)	0.0196 (0.0217)	-0.0482 (0.0759)
OBSOTA	0.00410* (0.00238)	0.0938 (0.0911)	0.285 (0.253)	0.0009(0.0087)	-0.0059 (0.0831)	0.0218 (0.198)
SMD	-0.0005(0.00699)	0.0118 (0.184)	0.0291 (0.528)	-0.0267 (0.0183)	0.234 (0.167)	-0.589 (0.504)
LP	1.100*** (0.346)	24.61 (26.33)	74.93 (72.35)			
ROA	0.0056 (0.0998)	0.464 (2.306)	1.316 (6.662)	0.690*** (0.260)	-5.841 (6.692)	15.43*** (5.583)
CO3	0.00824 (0.0157)	0.150 (0.502)	0.468 (1.437)	0.207*** (0.0725)	-1.784 (1.512)	4.612** (2.152)
GDP	0.0547* (0.0329)	1.065 (2.365)	3.287 (6.616)	0.132 (0.0993)	-1.158 (0.881)	2.910 (2.667)
INF	-0.00531 (0.0145)	-0.0649 (0.507)	-0.213 (1.439)	-0.0222 (0.0380)	0.199 (0.334)	-0.488 (0.904)
Const.	3.080 (5.218)	84.78* (44.15)	253.6* (140.0)	-19.38* (10.67)	170.7** (80.34)	-427.2 (328.9)
Obs.	131	131	131	125	125	125
chi2	115.23***	81.38***	62.34***	84.81***	10.69	19.28*

Where the dependent variables are: LLPTL, VROA, VROE and Z-score are the Risk measurements, TE1, TE2, TE3, TE4, TE5 are the Efficiency measurments, CAP is the Capital. The independent variables are: ROA is the Profitability, SIZE is the Bank Size, Liquidity is the Loan to total assets, Taxation is the Tax to pre-tax profit, OBSOTA is the Non-traditional activity, LP is the Labor Productivity, CO3 is the Concentration, SMD is the Stock market development, INF is the Inflation, GDP is the GDP growth. Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

5.6 Summary and conclusion

In this chapter, we investigate the relationship between bank efficiency/productivity, capital, and risk using data for 13 Jordanian commercial banks during the period 2003-2015. Our goal was to empirically address four hypotheses. And to that task, we applied four risk and efficiency measures in our three-stage least square structural equation modelling. And in the measurement of efficiency, we use the Data Envelopment Analysis (DEA) method.

According to financing theory, high levels of debt and low value of equity to asset ratio results in high risk which results in high rates of return which also explains the risk-return trade-off theory (Van Ommeren, 2011). Some studies explained that higher profits can be fetched by high equity to asset ratio which suggested by the study empirical evidence that ROA has a positive and statistically significant impact on banks' risk, while risk (all measures) has a negative impact on capital and efficiency. As suggested by the moral hazard hypothesis, managers of less-capitalized and low-efficient banks tend to engage in riskier investment decisions than usual (Jeitschko and Jeung, 2005) and in line with Empirical studies of (Demsetz et al, 1997) and (Salas and Saurina, 2003) report a negative effect of capital on the levels of credit risk taken by banks. The empirical results show that there is a negative and significant relationship between risk (Z-score) and capitalization as found by (Tan and Floros, 2013) in the context of the Chinese banking industry and suggested the financing theory, high levels of debt and low value of equity to asset ratio results in high risk. The results also indicate that bank size tends to reduce both risk and capital. While both off-balance-sheet activities and taxation are found to increase both banks' risk (LLPTL) and capital. (Kwan and Eisenbeis, 1997) provide evidence that efficiency and capital are relevant determinants of bank risk. (Jokipii and Milne, 2008) found a positive relationship between short term adjustments in banks' capital buffers and risk. This can be explained by the high concentration rate and the monopolistic nature of the banking market in Jordan. Stock Market Development (SMD) has a positive impact on bank capital and efficiency, while concentration ratio negatively affects risk, capital, pure technical efficiency, and scale efficiencies. Moreover, inflation is found to have a positive and robust effect on all efficiency measures.

This chapter was one of the first attempts to assess the effects of the CBJ reforms and deregulation policies on the productivity of the banking system in Jordan. Our analysis provides robust evidence in favor of the positive effects of these reforms. Policies adopted by

the Jordanian banks such as the increase in their dependence on interbank funding and the capital reserve, as well as their enhanced access to the deposit market, all contributed to improvements in profitability, cost-efficiency, and the overall operational efficiency of Jordanian banks. Another important factor that contributed to enhancing the Jordanian banking system efficiency during the study period is the decline in total provisions, which reduced banks' total expenses. The decrease in the NPLs have further improved banks' overall operational efficiency. The themes of this chapter carry important implications for Jordanian policymakers, banks' managers, ASE, and CBJ regulators. Mainly due to the major role of the banking system in economic development and growth, which also highlight the efficiency indicators as critical not only for decision-makers but also to bank managers who need to choose the right and appropriate regulatory environment. Improving the competitiveness of the banking sector is one dimension that requires the attention of bank regulators as it was found to be a significant factor in improving capital and efficiency measures and reducing risks in the Jordanian banking sector, in addition to contributing significantly to better access to credit by lowering financing obstacles for firms. Also, close attention should be given towards the development of the Amman stock market as it provides reliable information for investors that could help in decreasing wrong investment decisions and risk exposure. Jordanian banks are also suggested to further engage –cautiously- in the unconventional banks' off-balance-sheet activities as they contribute positively to banks' capital, but at the cost of higher risk.

CHAPTER 6

The Impact of Bank Efficiency and Competition on Cost of Credit: Evidence from Jordan's Banking System

6.1 Introduction

The Jordanian economy is a mix of different sectors. The services, industrial and banking sectors are the most important and profitable sectors in Jordan and have a huge contribution to the economic development. In terms of gross domestic product (GDP) generated, the mentioned sectors greatly value the Jordanian economy.

Despite its size, the country has one of the most developed and stable banking systems in the region. Looking at the development of the financial system, the Jordanian financial system may be categorized as a bank-based financial system in which banks play a pivotal role in financial intermediation, the transformation of savings into investments, allocation of scarce capital resources, risk sharing and risk diversification. One of the main roles of the country banking system is to provide households and business with the needed fund. the relationship between efficiency and competition on the cost of credit is one of the main subjects that have an impact on profitability and economic growth.

The objective of this chapter is to empirically test the effects of bank efficiency and competition on the cost of credit for borrowing firms using pooled OLS, Fixed effect (FE) and Random Effect (RE) methods based on data from 118 firms. In so doing, this chapter seeks to answer the main question. Whether competition affects the cost of credit and how changes in bank efficiency affect the cost of credit? The importance of this study lies in evaluating the policy measures that have been enforced by the Central Bank of Jordan (CBJ) to liberalize the banking sector in the banks' attempts to improve bank efficiency and, on the basis of the issues examined, fills an important gap in the literature on banking efficiency in developing countries using Jordanian data. In the literature, only a few studies have looked at the efficiency and competition of the banking sector in developing countries using Middle East region data on the

cost of credit. To check for the robustness of the generated results, we use different proxies for efficiency measures. The rest of the chapter is organized as follows: Section 6.2 provides a brief review of the literature. Section 6.3 presents the empirical approach. Section 6.4 presents the empirical results, and Section 6.5 provides the summary and conclusion.

6.2 Literature review

After the financial crisis of 2008, the Central Bank of Jordan prioritized safety over profitability inside the Jordanian banking sector with less attention is given to studying the impact of bank adopted safety measures on efficiency and productivity indicators of banks. A large body of empirical literature considers the influence of bank competition and efficiency on access to credit. Several studies have investigated how bank competition and efficiency influence access to credit (Beck et al., 2004); our work departs significantly from the existing empirical literature by focusing on the role of bank efficiency. The market power hypothesis, i.e. that greater bank competition is associated with better access to credit. For example, Beck et al. (2004) found a positive impact of bank concentration on financing obstacles. (Shamshur and Weill, 2019) found that bank efficiency reduces the cost of credit, where improvements in bank efficiency tend to be strongly associated with a lower cost of credit. (Sapienza, 2002) note that efficient banks are more able to offer borrowing firms' loans at lower costs than their less efficient competitors. Using a sample of Spanish small and medium-sized enterprises (SMEs), Carbo-Valverde et al. (2009) analyze the relationship between bank competition and credit availability, they found that greater bank competition is associated with lower credit constraints. For a sample of firms from 20 European countries, Ryan et al. (2014) examine the impact of bank competition measured by the Lerner index on credit. They found that bank competition diminishes credit constraints.

(Petersen and Rajan, 1995) found that lower loan rates are placed in the concentrated banking markets which supports the information hypothesis. In contrast, (Sapienza, 2002, for Italy; Kim et al., 2005, for Norway; and Degryse and Ongena, 2005, for Belgium) supports the market power hypothesis, and found a positive influence of bank concentration on loan rates. (Berger et al. 2005) and (Berger et al., 2017) found that large banks grant fewer loans to small businesses. (Laeven et al. 2014) found that large banks can consequently focus on a different set of activities to small banks.

Over the last two decades, the cost-efficiency of banks is a broad measure of bank

performance that has frequently been utilized in empirical banking literature. It measures the ability of a bank to operate at a lower cost by comparing its cost structure to that of a best-practice bank. The goal of improving the performance of financial institutions links to bank efficiency. One the other hand, recently the effects of bank competition on economic welfare and growth have huge attention. Increased competition in the banking industry has dubious benefits due to the peculiar features of the industry. Bank competition can be detrimental to financial stability, and the information asymmetries influence the relationship between bank competition and access to credit (Beck et al., 2006; Berger et al., 2009; Schaeck et al., 2009; Beck et al., 2013; Ryan et al., 2014).

A conflicting prediction of the impact of competition on access to credit has been shown in the literature. Greater bank competition relaxes financing constraints and leads to lower lending rates suggested by the market power hypothesis which is in line with the general economic theory that suggests that greater competition is associated with lower prices. The information hypothesis arguing that increased bank competition bolsters financing obstacles and drives up lending rates it is assumed that lower competition increases the incentive for banks to invest in relationship lending. Thus, a higher level of bank competition lowers investment in banking relationships and impairs access to credit (Petersen and Rajan, 1995; Dell'Ariccia and Marquez, 2006).

The majority of studies have shown a preference to investigate these dynamic relations using data for a selection of developed countries using various approaches. Examples include (Shamshur and Weill, 2019); (Sapienza, 2002). Thus, the present study is an important addition to the existing body of studies reported in the literature since 2000. Therefore, this chapter focuses on determining whether variables such as size, tangible assets, competition, efficiency, and growth are affecting the cost of credit. Furthermore, it is hoped that investors can use the results to make better funding decisions and thereby in profitable listed industrial and services companies in Jordan. This chapter examines how bank efficiency and competition influence the borrowing cost of 118 Jordanian firms in the industrial and services sector and using data for a sample of 13 Jordanian banks covering the period 2003-2015, contributes directly to the literature due to the shortage of studies that address the relationship between Jordanian bank efficiency and competition on the cost of credit.

6.3 Empirical Approach

6.3.1 Data

This chapter examines the magnitude and direction of the dynamic relationships between bank efficiency/productivity and competition on the cost of credit for 13 Jordanian commercial banks in response to the imposed capital requirements during the period 2003-2015. For the cost of credit models, we have a sample of 1521 firm observations for 118 firms in the industrial and services sector of the Jordanian market. Data are sourced from ASE, ABJ, and CBJ, and the commercial Jordanian bank's annual reports. Tables 6.1 present variables definitions and notations.

Table 6 1Variables' definitions and sources (cost of credit model).

Variables		Measurement	Type	Sources
Dependent Variables				
Cost of Credit	CostofCredit	(financial expenses /total debt) –interbank interest rate.	Bank-specific	Annual Reports
Independent Variables				
Firm size	Size	Natural logarithm of total assets	Firm-specific	Annual Reports
Tangibility	Tangibility	tangible fixed assets /total assets	Firm-specific	Annual Reports
Competition	Lerner	Measure of market power in the banking market that compares output pricing and marginal costs.	Bank-specific	World Bank.
Concentration	CO3	Assets of three largest banks as a share of total commercial banking assets	Bank-specific	Annual Reports
Efficiency	TE1	Technical efficiency	Bank-specific	Annual Reports
	TE2	Technological	Bank-specific	Annual Reports
	TE3	pure technical efficiency	Bank-specific	Annual Reports
	TE4	scale efficiency	Bank-specific	Annual Reports
	TE5	productivity	Bank-specific	Annual Reports
Inflation Rate	INF	Annual inflation rate	Macro	CBJ
GDP Growth rRte	GDP	Annual GDP growth rate	Macro	CBJ

6.3.2 Descriptive statistics

Tables 6.2 report the variables' descriptive statistics. The mean value of bank TE1, TE2, TE3, TE4, and TE5 are 100.42, 102.33, 100.31, 100.15, and 102.75 with the standard deviation approaching 6.99, 9, 6.35, 4.62, and 10.74 respectively. Regarding the cost of credit models, firm size, cost of credit, and tangibility have mean values of 7.50, 4.05, and 36.07 and standard deviations of values 0.61, 7.24, and 27.52 respectively. Lerner and CO3 have mean values of 37.21, 68.81301 and standard deviation values of 5.44 and 3.70 respectively. The five efficiency measures have mean values of 100.42, 102.33, 100.31, 100.15, 102.75 and standard deviation values of 6.99, 9.00, 6.35, 4.62, and 10.74 respectively. Inflation and GDP have mean values of 4.74, 4.14 and standard deviation values of 2.47, and 3.44 respectively.

Table 6 2Summary statistics (cost of credit model)

VARIABLES	Obs	Mean	Std. Dev.	Min	Max
Cost of Credit	1,164	4.0596	7.2462	-6.495	101.93
Firm Size	1,253	7.5044	.6147	5.7355	9.2513
Tangibility	1,250	36.0709	27.5217	.0033	97.9373
Lerner	1,521	37.2153	5.4468	22	43.6557
C3	1,521	68.8130	3.7012	62.6021	76.0322
TE1	1,521	100.429	6.9908	82	147.6
TE2	1,521	102.337	9.0058	75.6	128.5
TE3	1,521	100.313	6.3561	74.1	144
TE4	1,521	100.153	4.6224	83.3	126.5
TE5	1,521	102.758	10.7452	75.6	145.5
GDP	1,521	4.7430	2.4796	2.3	8.53
INF	1,521	4.1469	3.4460	-.7	14

This table provides descriptive statistics for the main firm-level variables used in the econometric analysis.

Note: statistics calculated using STATA 5.1.

6.3.3. Efficiency and cost of credit models

Our empirical strategy draws on the insights of (Shamshur and Weill, 2019) and use the pooled, FE, and RE modelling used to estimate the models. TE, TE2, TE3, TE4, and TE5 is the proxy for the bank's efficiency and measured using the Malmquist productivity index. Bank, Ind, and Mac are the bank-specific, industry-specific and macroeconomic factors that

influence the efficiency/productivity and cost of credit relationship. We use the Malmquist Productivity Index (MPI) to calculate efficiency (TE). Malmquist productivity index uses input and output distance functions to measure changes in productivity. The index is calculated based on s-technology and is expressed as follows:

$$m_0^s(q_s, q_t, x_s, x_t) = \frac{d_0^s(q_t, qx_t)}{d_0^s(q_s, x_s)} \tag{6.1}$$

In this study, we use the non-parametric methods represented by the Malmquist index proposed by (Malmquist, 1953) and later developed by (Douglas et al., 1982). This index measures total factor productivity between two banks or one bank over time. We also measure technical efficiencies using the non-parametric method, DEA. DEA technique utilizes the number of variables (inputs and outputs) and not their prices and thus does not require any relationship between inputs and outputs. Using more than one form of inputs and outputs of the Decision-Making Unit (DMU) is one of the DEA advantages (Graham et al., 2005). Defining and selecting banks' inputs and outputs for the DEA method is based on one of three approaches, production approach, intermediation approach, and value-added approach. We also use the intermediation approach in the selection of inputs and outputs which defines the bank as an intermediary that transfers assets from surplus units to deficit units (Paul and Kourouche, 2008), (Alkhathlan and Malik, 2010). In calculating the index we use four inputs (number of full-time employees, total deposits, total assets, and interest expenses) and two outputs (loans and interest income) following (Varesi, 2015). Loans are considered one form of output from deposits (inputs) as noted by (Sealey and Lindley, 1977), (Lang and Welzel, 1996), and (Ashton and Pham, 2011).

The key firm-level variable is the cost of credit which measures the difference between the ratio of financial expenses divided by bank debt and the interbank interest rate. Bank debt is the sum of short-term and long-term debts (Altunbas et al. 2007). Using the implicit interest rate component as part of the variable is consistent with the fact that the majority of our sample consists of micro and small enterprises. These firms in general lack access to non-bank funding sources, thus loan expenses are their main funding costs. Following (Shamshur and Weill, 2019) we use two firm-level control variables. The first is firm size (natural logarithm of total assets), since firms of different sizes have different financing needs and patterns. The second is tangibility (ratio of tangible fixed assets to total assets). A greater share of tangible fixed assets facilitates credit accesses. We also consider two macro-specific control variables, GDP

and Inflation.

Since our main goal is to analyse the impact of bank efficiency and competition on the cost of credit, we regress the cost of credit on the five efficiency scores and a set of control variables as shown in Models 6.2 and 6.3 below:

$$y_{it} = \alpha + \beta X_{it} + \gamma Z_{it} + Efficiency_{it} + Competition_{it} + \varepsilon_{it} \quad (6.2)$$

$$CostofCredit_{it} = \alpha + \beta_1 Size_{it} + \beta_2 Tangibility_{it} + \beta_3 Lerner_{it} + \beta_4 CO3_{it} + \beta_5 TE_{it} + \delta_1 GDP_{it} + \delta_2 INF_{it} + \varepsilon_{it} \quad (6.3)$$

where *y* it is the cost of bank credit for firm *i* in year *t*; X is a set of firm-specific variables (firm size, tangibility); Z is a set of macro-specific variables (GDP, Inflation) and ε_{it} is a random error term. Our main independent variables are efficiency (TE1, TE1, TE3, TE4, TE5) and competition (Lerner Index) measures. The endogeneity problem is greatly reduced since bank efficiency is computed at the bank level, while the cost of credit is firm-level information obtained from a different data source. All models are estimated with Pooled OLS, FE and RE methods. Estimation results appear in Table 6.3 and 6.4.

6.3.4 Empirical methodology

We estimate our cost of credit models using Pooled OLS, FE and RE methods. We estimate five models incorporating each one of the efficiency measures as the main independent variables while controlling for a set of firm, industry and macroeconomic variables. We start our analysis by pooling the panel data and estimating it using ordinary least squares (OLS) regression. This method ignores the firms' heterogeneities and un order to correct for this bias, we use both FE and RE approaches to account for the distinct nature of each firm and control for the unobserved fixed effects that are constant over time and correlated with the dependent variables, such as Jordan's geographical location and cultural norms. These methods capture the within-variation across firms and time-related shocks that affect all firms such as global financial crises (Bjorvatn and Farzanegan, 2013). We also use RE method, wherein the main difference between RE and FE is that RE uses GLS to produce the estimates while assuming that the unobserved heterogeneity is uncorrelated with the regressors. As we using panel data, the FE and RE methods are the more appropriate way to estimate the coefficients of the

parameter and explain the relationship between variables.

6.4 Results

6.4.1 Efficiency, Competition and cost of credit results

Table 6.3 and 6.4, reports the OLS, FE and RE estimations results of Model 6.2 and 6.3. We divided the sample into to sub-sample; large and small firm size. The result show that firm size and GDP are the main moderators of the cost of credit in all models. Our results are in line with (Fungáčová et al., 2014). Small firms have limited access to credit facilities and they tend to incur larger loan costs when borrowing from banks relative to bigger firms. The negative coefficient of GDP implies that during periods of economic development the cost of credit tends to be smaller due to lower information asymmetries (Godlewski, 2004). A high Lerner index, which measures the extent of competition between banks, reduces cost of credit. According to the market power and information hypotheses which suggest that greater bank competition reduce loan rates. As competition intensifies the operational efficiency of the banks tends to improve. Efficient banks are more able to offer borrowing firms' loans at lower costs than their less efficient competitors as (Sapienza, 2002) notes. Thus, bank efficiency has no significant impact on the cost of credit. Finally, inflation increases the cost of credit. During inflationary periods the value of money diminishes and this, in turn, forces firms to borrow more to sustain their operations. A large demand for loans prompts banks to levy higher charges for that credit, so borrowing costs rise. greater economic development tends to reduce the cost of credit. This might be explained by the fact that access to credit is easier in developing countries, so young, riskier firms are also able to obtain credit.

The results show that no differences in findings in regards to the impact of variables on the cost of credit for both large and small banks. Th e only difference found with the Tangibility as the variable show a positive significant impact on the cost of credit in the large size firms while it is insignificant for the small size firms. The positive relation explained as the Tangibility defined as the ratio of tangible fixed assets to total assets. A greater share of tangible fixed assets that could serve as collateral can contribute to easier access to credit and may indicate better opportunities for obtaining external financing.

Table 6 3OLS, Fixed and random estimations for the relationship between cost of credit, bank efficiency and competition.

	Model where Efficiency = TE1		Model where Efficiency = TE2		Model where Efficiency = TE3		Model where Efficiency = TE4		Model where Efficiency = TE5	
	Pooled OLS	**RE**	**Pooled OLS**	**FE**	**Pooled OLS**	**FE**	**Pooled OLS**	**RE**	**Pooled OLS**	**RE**
Size	-1.088***	-1.082**	-1.082***	-1.858	-1.080***	-1.076**	-1.099***	-1.088**	-1.096***	-1.097**
	(0.347)	(0.525)	(0.348)	(1.410)	(0.348)	(0.525)	(0.347)	(0.528)	(0.347)	(0.512)
Tangibility	0.0090	0.0084	0.0089	0.0085	0.0089	0.0083	0.0090	0.0084	0.0090	0.0083
	(0.0075)	(0.0103)	(0.0075)	(0.0169)	(0.0075)	(0.0103)	(0.0075)	(0.0103)	(0.0075)	(0.0101)
TE1	0.0844	0.0706	-0.0784	-0.0886	0.112	0.0936	-0.0129	-0.0100	-0.0348	-0.0440
	(0.0932)	(0.0856)	(0.0702)	(0.0665)	(0.105)	(0.0968)	(0.197)	(0.180)	(0.0760)	(0.0704)
Lerner	-0.0794*	-0.0852**	-0.0867*	-0.101**	-0.0829*	-0.0880**	-0.0655	-0.0737**	-0.0694*	-0.0780**
	(0.0428)	(0.0393)	(0.0443)	(0.0407)	(0.0432)	(0.0397)	(0.0401)	(0.0368)	(0.0409)	(0.0377)
CO3	0.150	0.150	0.197*	0.191*	0.146	0.146	0.141	0.143	0.162	0.169
	(0.105)	(0.0977)	(0.116)	(0.108)	(0.105)	(0.0975)	(0.106)	(0.0983)	(0.114)	(0.106)
GDP	-0.769***	-0.768***	-0.775***	-0.796***	-0.762***	-0.762***	-0.726***	-0.733***	-0.732***	-0.738***
	(0.133)	(0.122)	(0.132)	(0.123)	(0.129)	(0.119)	(0.131)	(0.120)	(0.125)	(0.116)
INF	0.167**	0.155**	0.216**	0.217**	0.179**	0.165**	0.143**	0.134**	0.165**	0.163**
	(0.0683)	(0.0627)	(0.0908)	(0.0869)	(0.0713)	(0.0655)	(0.0627)	(0.0575)	(0.0792)	(0.0733)
Const.	-1.022	0.666	12.22	20.13	-3.502	-1.412	8.853	8.789	9.698	10.61
	(11.88)	(11.46)	(8.348)	(14.89)	(12.65)	(12.14)	(21.56)	(20.09)	(8.635)	(8.850)
Obs.	1,162	1,162	1,162	1,162	1,162	1,162	1,162	1,162	1,162	1,162
R-squared	0.048	117	0.048	0.053	0.048	117	0.047	117	0.047	117

Where the dependent variable is: CostofCredit is the Cost of Credit. The independent variables are: Size is the Firm size, Tangibility is the Tangibility, Lerner is the Competition, CO3 is the Concentration, INF is the Inflation rate, GDP is the GDP growth rate. Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 6 4OLS, Fixed and random estimations for the relationship between cost of credit, bank efficiency (total factor productivity) and competition (Large and Small Companies 2003-2015).

	Large Firm Size		Small Firms Size	
	Pooled OLS	**RE**	**Pooled OLS**	**RE**
Size	-.3382	-.3382	-18.939	-18.9396
	(2.3028)	(2.3028)	(19.6208)	(19.6208)
Tangibility	.0903***	.0903***	.0221	.0221
	(.0230)	(.0230)	(.3240)	(.3240)
TE5	-.0481	-.0481	-5.5930*	-5.5930
	(.2026)	(.2026)	(3.3368)	(3.3368)
Lerner	-.0908	-.0908	-.3265	-.3265
	(.1142)	(.1142)	(1.7497)	(1.7497)
CO3	.0773	.0773	.5231	.5231
	(.2922)	(.2922)	(5.1314)	(5.1314)
GDP	-.4688	-.4688	6.5157	6.5157
	(.3325)	(.3325)	(5.4854)	(5.4854)
INF	.1417	.1417	3.4530	3.4530
	(.2229)	(.2229)	(3.4414)	(3.4414)
Const.	7.1287	7.1287	650.305	650.305
	(30.3846)	(30.3846)	(427.1104)	(427.1104)
Obs.	152	152	999	999
R-squared	0.1490	0.5014	0.0058	0.3577

Where the dependent variable is: CostofCredit is the Cost of Credit. The independent variables are: Size is the Firm size, Tangibility is the Tangibility, Lerner is the Competition, CO3 is the Concentration, INF is the Inflation rate, GDP is the GDP growth rate. Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

6.6 Summary and conclusion

In this chapter, we investigate the relationship between bank efficiency, competition on the cost of credit using data for 13 Jordanian commercial banks and 118 firms during the period 2003-2015. In the measurement of efficiency, we use the Data Envelopment Analysis (DEA) method. Unlike what was expected, the efficiency of the banking sector has no impact on firms' cost of credit, other determinants such as firm size, bank competition, and GDP are found to be the main moderatos of the borrowing costs. Our results are in line with (Fungáčová et al., 2014)

This chapter was one of the first attempts to assess the effects of the CBJ reforms and deregulation policies on the productivity of the banking system in Jordan. Our analysis provides robust evidence in favor of the positive effects of these reforms. Another important factor that contributed to enhancing the Jordanian banking system efficiency during the study period is the decline in total provisions, which reduced banks' total expenses. The themes of this chapter carry important implications for Jordanian policymakers, banks' managers, ASE, and CBJ regulators. Mainly due to the major role of the banking system in economic development and growth, which also highlight the efficiency indicators as critical not only for decision-makers but also to bank managers who need to choose the right and appropriate regulatory environment. Improving the competitiveness of the banking sector is one dimension that requires the attention of bank regulators as it was found to be a significant factor in improving capital and efficiency measures and reducing risks in the Jordanian banking sector, in addition to contributing significantly to better access to credit by lowering financing obstacles for firms. Jordanian banks are also suggested to further engage –cautiously- in off-balance-sheet activities as they contribute positively to banks' capital, but at the cost of higher risk.

Thus, our findings are of particular importance to policymakers who aim to design policies improving access to credit. Specifically, fostering bank efficiency could play an important role in financing the economy as a whole. The results show that minimizing the entry restriction of new banks improves competition the market, which will help lower the cost of fund for the large and small firms, resulting in improved and enhanced growth.

Chapter 7

Liquidity Funding and Risk-Taking Behavior of Jordanian Commercial Banks

7.1 Introduction

Before the global financial crisis of 2008, the banking sector in Jordan did not have a functioning credit risk management system and, as a result, many banks were found to be either ill-prepared to be well-positioned to safely manage and control the transmission of shocks to the financial system or inadequate. This was made more apparent by the excessive losses incurred by the Housing Bank (Jordan's largest bank), due to the collapse of subsidiaries in neighbouring countries such as Syria. At the time of the announcement, banking officials announced that the financial losses incurred could have been avoided had there been in place internal credit risk management system capable of anticipating the occurrence of credit events that might threaten the financial viability of the bank. A credit event or credit risk is not the only risk faced by banks, since banks are exposed to various types of risk including market risk, and liquidity risk. While credit risk has received much attention in the literature, it was only at the height of the global financial crisis that researchers began to pay attention to the implications of liquidity risk for the financial system and the wider economy. Liquidity risk measures the ability of banks to cover their obligations and to expand their resources via acquiring new assets. This suggests that when one bank within the banking system fails to secure stable liquidity funding it creates a potential threat to the whole banking system.

Banks generally face two types of liquidity risk. The first relate to liquidity funding, while the second relates to market liquidity. Liquidity financing refers to the sustained efforts of the banks to satisfy their commitments in due time. The capability of banks to manage this type of risk has in recent time become increasingly difficult, especially during times of financial market stresses and failure. For example, the collapse in the value of mortgage related assets has led to liquidity problems affecting entire financial systems. Such financial system failure has the potential to impede the ability of banks to meet immediate obligations thereby resulting in the failure of the banking system. It is for this reason why liquidity risk is considered one of

the main threats to financial system stability and, in turn, why maintaining liquidity buffer is touted as key strategy to mitigate these risks. Several studies, such as (Hong et al., 2014) report that banks' failure in managing liquidity risk is one of the main triggers of the 2008 global financial crises, and (Acharya and Naqvi, 2012) note that maintaining high levels of assets increase bank risk. (Keeley, 1990), however, notes that deposits tend to decrease liquidity risk, while deposit insurance increase banks' moral hazard. The point being that the ensued moral hazard can lead to a vicious cycle where banks might be tempted to make excessive risk-taking choices in order to fund their liquidity, thereby threating the bank's stability. It is for this reason why studies such as (Acharya and Naqvi, 2012) and (Ivashina and Scharfstein, 2010) advocate the bank risk-mitigating effects of lowering liquidity funding risks.

The purpose of this chapter is to first investigate the impact of liquidity funding measures on the risk of Jordanian commercial banks using Fixed (FE) and Random (RE) effects models. And the second is to analyze the impact of the deposit insurance scheme applied in Jordan on the liquidity creation of Jordanian commercial banks using the Difference in Difference (DiD) approach for the period 2003-2015. This study utilizes z-score as a measure of overall bank risk, liquidity creation as a measure of a bank's default, and loan-loss provision and risk-weighted assets as measures of a banks' assets quality. Our empirical analysis also incorporates a set of control variables to account for other factors that influence liquidity-funding risks such as capital, size, interest rate, and selected macroeconomic variables. To check for the robustness of the generated results, we use different proxies for banks' risk measures. To the best of our knowledge, the analysis presented in this chapter is the first of its kind to shed light on the linkages between liquidity-funding measures and the risk-taking behavior of Jordanian commercial banks as well as the factors affecting their risk levels. Furthermore, the empirical results navigate the policies of decision-makers into the direction of effective risk-mitigation and management. Such careful formulation of policies will hopefully make the banking system less vulnerable to global and regional financial and economic shocks.

This chapter is organized as follows. Section 7.2 summarizes the literature and the theoretical motivations for the aim of the study. Section 7.3 presents an overview of the institutional background of the Jordanian banking system. Section 7.4 describes the data and methodology. Section 7.5 presents the results and discussion. Finally, the conclusion is provided in Section 7.6.

7.2 Literature review

Until recently, liquidity creation was not a focal theme in the empirical literature. Starting with the pioneering work of (Berger and Bouwman, 2009), who developed the first detailed liquidity development measure that includes all bank balance sheet items (assets, liabilities, equity, and off-balance sheet activities), as well as positive (both illiquid assets and liquid liabilities) and negative weights (liquid assets, illiquid liabilities, and equity) for measurement of liquid assets and liquid liabilities, which they applied to a panel of U.S. banks for the period 1993-2003. (Berger and Bouwman, 2009) report that in general liquidity creation increased over time and that in large banks the relationship between capital and liquidity creation is positive while the same relationship is negative for small banks. Others researchers such as (Fidrmuc et al., 2015), (Berger et al., 2016), and (Fungáčová et al., 2017) extend (Berger and Bouwman's, 2009) approach to examine the determinants of liquidity creation and its consequences for financial stability. While (Lei and Song, 2013), (Fungáčová et al., 2017) have shown that size and deposit insurance may be among the reasons for the negative association between capital and liquidity creation which might explain why liquidity creation increases the probability of bank failure (Fidrmuc et al., 2015). On a related issue, (Berger et al., 2016) note that liquidity creation is sensitive to regulatory interventions and bailouts and to monetary policy depending on the general economic conditions, while (Hankir et al., 2011) suggests that bank size might be a key factor. Using data for Chinese banks, (Lei and Song, 2013) found a negative relationship between liquidity creation and bank capital and (Berger and Sedunov, 2017) point to macroeconomic variables such as economic growth as factors with the potential to foster a positive association between bank liquidity creation in the US. (Fidrmuc et al., 2015) provides similar reasons for Russia.

Turning to the determinants of risk, (Bluhm and Krahnen, 2014) argue that systemic risk increases with increase in liquidity supplies from central banks. (Cifuentes et al., 2011) and (Gauthier et al., 2012) note that capital adequacy, interbank assets, and illiquid assets are among the risk determinant factors. The risk absorption hypothesis suggests that when banks have higher risk tolerance, banks with more capital, are better able to absorb more risk, which allows them to create more liquidity (Bhattacharya and Thakor, 1993, Coval and Thakor, 2005, Repullo, 2004, and von Thadden, 2004).

Studies such as (Peek and Rosengren, 1995) report evidence which suggest that lending activities decreased as a result of the reduction in bank capital ratios incurred from loan losses,

while (Diamond and Rajan, 2000, 2001) suggest that having more capital translates into larger liquidity creation. In contrast, (Gorton and Winton, 2005) cautions that increasing bank capital and deposits can cause a decrease in liquidity creation, while (Berger et al., 1994), (Hancock et al., 1995) and (Peek and Rosengren, 1995) report the presence of a negative association between bank liquidity creation and capital.

In order to effectively manage liquidity risks, banks are required to maintain a buffer of liquidity as one means of protection against possible shocks. Recently, it has been shown by (Hong et al., 2014) that liquidity risk was one of the main contributors of the 2009-2010 bank failures. Based on the theoretical insights of (Acharya and Naqvi, 2012) and (Wagner, 2007), bank risk and quality of assets were found to be positively correlated and banks with higher deposits were characterized as having less funding liquidity risk, which the feeds into the bank risk-taking behavior. (Keeley, 1990) noted that deposit insurance can also feed into a bank's risk-taking behavior.

Following (Jensen, 1986) hypothesis, it may be argued that when bank managers have free cash flows, that they might be tempted to make poor investment decisions that increase bank risk taking behavior. In the literature, there does exists some evidence for the negative association between bank risk and lower funding liquidity risk. For example, (Ivashina and Scharfstein, 2010) found that bank excessive lending behavior during times of access to large deposit funding contributed to the triggering of the 2008 global financial crises. And (Wagner, 2007) notes that banking system instability increases with higher liquidity. However, (Marques-ibanez et al., 2014) have argued that low-interest rates increase banks risk behavior, while (Berger and Bouwman, 2012) report findings which indicate that the monetary policy effects on liquidity creation can be larger for small banks than for large banks. On the other hand. (Kashyap and Stein, 2000) found no such evidence of the impact of monetary policy on lending or liquidity creation.

7.2.1 Theoretical motivation

Our fourth empirical investigation well supported by existing theoretical frameworks in the literature. Starting with (Acharya and Naqvi, 2012) who show theoretically the result of large amounts of deposit inflows, banks have lower funding liquidity risk and the bank managers take more risk by lowering the lending rate aggressively to increase loan volumes in order to enhance their own compensation. For example, if the bank's funding liquidity deficit

is sufficiently large, an audit should be performed to investigate managers' decisions regarding the lending standard as a part of risk management. In relation to aggressive lending, banks may face a capital shortfall, which may trigger bank failure. The classical principal-agent theory, (Cheng et al. 2015) shows that risk-averse managers require higher compensation levels to work in riskier financial firms that put their wealth under greater uncertainty. Hence, to achieve the higher compensation levels required by managers to work in riskier banks, they follow aggressive lending strategies as a result of the large amounts of deposit inflows. We develop our core hypotheses in the subsequent section.

7.3 Institutional background of the Jordanian banking system

In 2000, Jordan deposit insurance corporation (JODIC) was established as a financially and administratively independent corporation to reimburse depositors with the maximum coverage limit of JD 50,000 per depositor. JODIC objective is maintaining the effectiveness of the explicit-limited deposit insurance system in Jordan as well as providing full protection to depositors. The ratio of insured depositors reached 97.4 percent of total eligible depositors by the end of 2018. All Jordanian banks and branches of foreign banks operating in Jordan are under the umbrella of JODIC. The ultimate objective of JODIC is managing the liquidation processes efficiently and forcing banks to adopt proper risk management policies. In 2015, the Central Bank of Jordan (CBJ) informed the banks about a set of instructions for implementing the Basel III requirements. Starting with the regulatory capital components under the Basel III agreement, Jordanian banks were required to maintain the following measures as ratios of each bank risk-weighted assets (RWAs): minimum common equity capital (CET1) of 6.0 percent, maximum additional Tier-1 capital (AT1) of 1.5 percent, maximum Tier-2 (supplemental) capital of 2.0 percent, mandatory capital conservation buffer, equivalent to 2.5 percent, minimum capital adequacy ratio of 12.0 percent for banks inside Jordan and 14 percent for banks outside Jordan. Domestically-important systemic banks were also required to specify clearly the methodology for calculating the countercyclical capital buffer and the capital buffer required to enhance their methodologies for calculating capital levels in the event of operational risks by including the standardized approach, and to include a section for the calculation of leverage ratio (LR), and the recalculation of minority interest in regulatory capital.

Following the implementation of the Basel III requirements, capital adequacy requirements has increased relative to levels that prevailed during the implementation of the

Basel II requirements. The high capital adequacy ratios for most of the Jordanian banks are attributed to the different methods of processing investments in other banks, insurance companies, and financial institutions. The main component of Jordanian banks' capital is CET1 that includes high-quality capitals. According to the Basel III, there are limits to the deductions from regulatory capital, with only investments that are above 10.0 percent of CET1 for the investment bank. Whereas other investments should be included in the risk-weighted assets.

Table 7.1 and Figure 7.1 show that the ratio of financial sector assets /GDP is close to the ratio of the banking sector assets to GDP amounting to 94.1 percent. The rate of financial sector assets to GDP is declined over time reflecting the economic and structural reforms during the study period. In 2007, the same ratio reached 160 percent in response to the global financial crises and correspond to the increase in insurance sector assets from 467 Million JD in 2006 to 546 Million JD in 2007.

Figure 7. 1 The Jordanian Financial Sector Assets GDP (2003-2017).

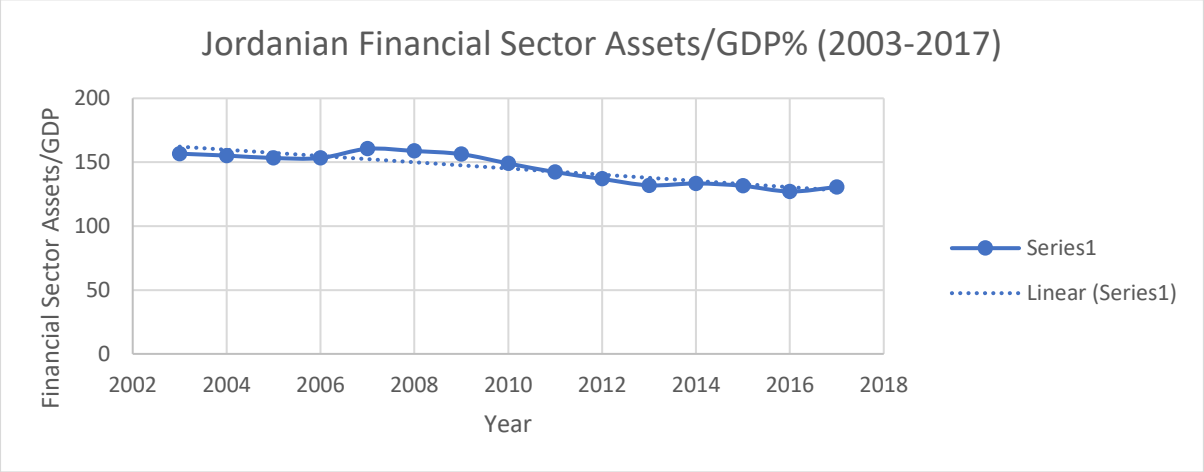


Figure 7.2 shows the declining trend of the share percentage of Jordanian bank assets to Jordanian GDP during the period 2003-2017. The highest value, 155.1 percent, was at the end of 2003 before it decreased to 110.5 percent at the end of 2016 as a result of the economic slowdown. Due to the 2017 modest growth rates, bank assets to GDP ratio started to increase, though the increase was temporary due to the political instability of neighboring countries, and the slowdown in global economic activity.

Figure 7. 2 The Jordanian Banking Sector Assets GDP (2003-2017).

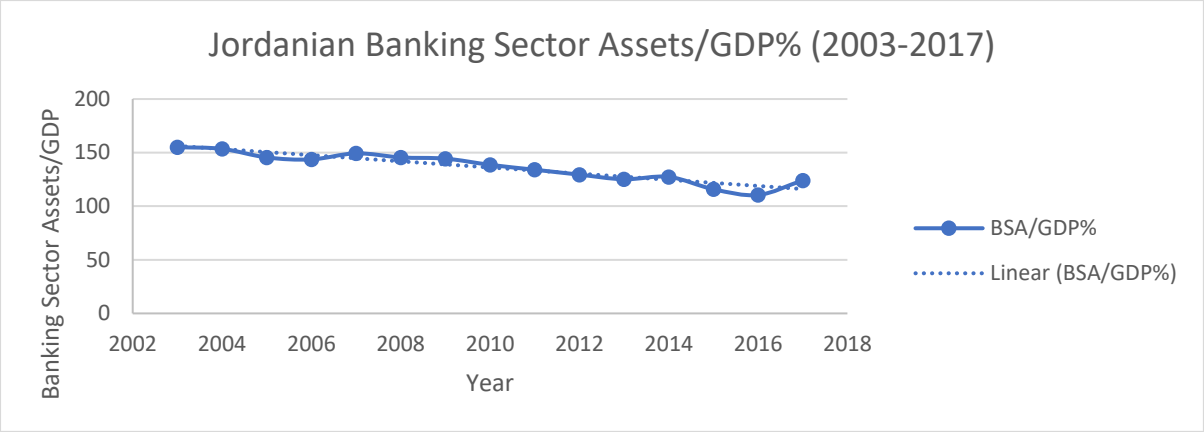


Table 7 1The Jordanian Financial and Banking Sector Assets to GDP (2003-2017).

Year	Financial Sector Assets FSA	Banking Sector Assets BSA	GDP	FSA/GDP%	BSA/GDP%
2003	24600993368	24354128778	15701500000	156.6793	155.1070
2004	27654935684	27360826500	17821100000	155.1809	153.5305
2005	32326758291	30681845191	21086500000	153.3055	145.5047
2006	37148152638	34819032775	24237600000	153.2666	143.6571
2007	43039454268	40045732144	26815600000	160.5016	149.3374
2008	47307300812	43357261576	29796600000	158.7675	145.5108
2009	49950755209	46142487538	31956900000	156.3066	144.3897
2010	52124970563	48477966019	34973100000	149.0430	138.6150
2011	53618237189	50516950642	37686400000	142.2748	134.0456
2012	53781256010	50851049780	39275400000	136.9337	129.4730
2013	56464591349	53564754962	42802800000	131.9180	125.1431
2014	59842710711	57154358829	44868100000	133.3747	127.3831
2015	61992086490	54600231585	47133200000	131.5253	115.8424
2016	61481192355	53468221280	48383500000	127.0706	110.5092
2017	64117629063	60943120053	49102500000	130.5792	124.1141

Source: ABJ; CBJ (Stability Report).

7.4. Methodology

Our analysis starts with estimating our models using the constant coefficients (pooled regression) model. The basic results of the pooled models are problematic because they assume that our cross-sections are not heterogeneous and that the average values of the variables are constant across banks. To solve this problem, we use a fixed/random effects model (Brooks, 2008). The fixed-effects model decomposes the error term into an entity-specific effect and a remainder error which varies over time and entities. The estimations results using FE, GLS and pooled OLS are reported in Tables 7.5 – 7.13.

The random-effects model similar to the fixed-effects model proposes different intercepts for each entity and/or each time period to get rid of correlations between error terms. Generally, the random-effects model should be more efficient than the fixed-effects model

since fewer parameters will be estimated; therefore, degrees of freedom are saved, since the GLS method of the random effects removes only exactly as much of the variation in the variables as is needed to remove the correlation in the error terms. To account for the problem of endogeneity of some right-hand side variables we use one-period lags of the independent variables. For example, reverse feedback effects can be found between bank risk measures and macroeconomic indicators. The argument behind using lagged values is that the current values of the dependent variable cannot influence the past values of the independent variables (Bjorvatn & Farzanegan, 2013). Time effects are separated by inducing first differences, that is with the assumption that time effects are varying over time. Second, the event has been controlled in the regression and from the sample by the dummy variable which captures the treatment/intervention effect. And even so, Fixed effects also controls for potential individual sample effects. For testing the impact of the deposit insurance scheme, we use the DiD approach. The estimations results appear in Tables 7.14 and 7.15. We compare changes in liquidity creation before and after the implementation of deposit insurance. DiD is typically used to estimate the effect of a specific intervention (deposit insurance scheme) by comparing the changes in outcomes over time between a group that is enrolled in a program and a group that is not. The DiD approach provides results that are robust to the potential endogeneity bias (Cao, Zhun et al., 2011).

7.4.1 Data and empirical models

This section empirically examines the nature of the relationship between Jordanian commercial banks' liquidity funding and risk-taking behavior using annual data during the period 2003-2015. Our task is to test the four hypotheses earlier discussed in section 7.2.1. The first is that having low liquidity funding risk incentives banks to take risky decisions and increases the probabilities of banks default. The second hypothesis is that banks with high capital buffers are less risk-taking in response during the periods of low funding liquidity risks. The third hypothesis is that larger banks are less likely to face risks during lower funding liquidity times, and the final hypothesis is that the 2008 financial crisis caused banks to be less willing to make risky decisions to fund liquidity. The annual balanced panel data for 13 Jordanian commercial banks are sourced from ASE, ABJ, and CBJ, and the commercial Jordanian bank’s annual reports. The selection of the variables is based on the work of (Khan et al., 2017). Tables 7.2 and 7.3 report the list of the variables, their definitions, and their descriptive statistics.

Table 7 2Variables' description and definitions

Variable	Notation	Measurement	Type	Source
Dependent Variables				
Liquidity Creation	LC	Liquidity creation/total assets. Liquidity creation = 0.5 ×illiquid assets + 0.5 ×liquid liabilities −0.5 ×liquid assets −0.5 ×illiquid liabilities −0.5 ×equity	Bank-specific	Annual Reports
Loan loss provision	LLP	Loan loss provision/ total assets	Bank-specific	Annual Reports
Risk-weighted asset	RWA	Risk-weighted asset/total assets	Bank-specific	Annual Reports
Z-scores	Z-scores	Log [{return on assets + (equity/asset)}/standard deviation of return on assets]	Bank-specific	Annual Reports
Independent variables				
Liquidity Funding Risk	Dep	Total Deposit /total assets	Bank-specific	Annual Reports
Capitalization	CAP	Total equity/total assets	Bank-specific	Annual Reports
Size	Asset	Natural logarithm of total assets	Bank-specific	Annual Reports
Profitability	ROA	Net income/total assets	Bank-specific	Annual Reports
Profitability	ROE	Net income/total equity	Bank-specific	Annual Reports
Loan	Loan	Total Loans		
None Performing Loans	NPL	None Performing Loans		
Interbank Interest Rate	IRB	The interest rate on interbank transactions	Macro	CBJ
Loan Interest Rate	IRL	The interest rate on loans	Macro	CBJ
Monetary Policy Interest Rate	MIR	The repurchase rate	Macro	CBJ
GDP Growth Rate	GDP	Growth rate of GDP	Macro	CBJ
Unemployment Rate	Unemploy	unemployment rate	Macro	CBJ
Inflation Rate	INF	Annual Inflation Rate	Macro	CBJ
Realized financial Crisis	RFC	measured by the use of a dummy variable		
Deposit Insurance Scheme	JDIC	measured by the use of a dummy variable		

Source: ASE, CBJ.

Table 7 3Summary Statistics

VARIABLES	Obs	Mean	Std. Dev.	Min	Max
LC	167	28.2883	9.8044	-1.4860	66.4363
Zscor	169	6.7126	6.2033	-0.3891	30.9863
LLP	153	0.4524	4816831	-0.3908	3.2434
RWA	113	68.0309	10.7296	37.4421	96.2632
Dep	169	74.2300	6.5468	54.1497	85.6735
Loan	169	43.8407	10.5181	0.2785	60.2790
CAP	169	13.2016	4.6503	-31.3546	21.9640
Ass	169	9.1439	0.4973	7.8250	10.4126
ROA	169	1.4344	0.7123	-1.01	4.97
ROE	169	10.5228	5.5591	-2.24	39.84
NPL	143	23.0830	84.4496	.2	650
IRB	169	3.5822	1.3296	1.964	6.495
IRL	169	8.7169	0.4759	7.59	9.48
MIR	169	5.0962	1.5348	3.5	8.5
UNM	169	13.2231	0.9244	11.9	14.8
GDP	169	4.7431	2.4796	2.3	8.53
INF	169	4.1469	3.4461	-.7	14

Note: statistics calculated using STATA 5.1.

The risk measures (LC, LLP, RWA, and Z-score) have means of 28.2, 0.45, 68, and 6.71 and standard deviations of 9.8, 0.48, 10.72 and 6.20 respectively. The mean bank Dep is 74.2 with standard deviation approaching 6.5. Loan is, on average, 43.8 with a standard variation of 10.5. CAP is, on average, 13.2 with a standard variation of 4.6. Size is, on average, 9.14 with a standard variation of 0.49. The ROA mean is 1.4 with a standard deviation of .71. The ROE mean is 10.5 with standard deviation of 5.5. The NPL mean is 23 with standard deviation of 84.4. The IRB mean is 3.5 with standard deviation of 1.3. The IRL mean is 8.7 with standard deviation of .47. The MIR mean is 5.09 with standard deviation of 1.5. The UNM mean is 13.2 with standard deviation of .92. The GDP mean is 4.74 with a standard variation of 2.47. The Inflation mean is 4.14 with a standard variation of 3.44.

For calculating liquidity creation, we consider the following variables – the fixed assets, loan, intangible assets, investments in affiliates, other assets, cash, balances at banks and financial institutions, deposits at banks and financial institutions, trading investments available for sale, investments held to maturity investments, net deposits, loans and borrowing, other

liabilities, and total equity. Table 7.4 provides a summary of the list of determinants. Our empirical approach follows (Berger and Bouwman, 2009):

$$Liquidity\ Creation = 0.5 \times Illiquid\ Assets + 0.5 \times Liquid\ Liabilities - 0.5 \times Liquid\ Assets - 0.5 \times Illiquid\ Liabilities - 0.5 \times Equity. \quad (7.1)$$

Table 7 4Summary of liquidity creation calculation: liquidity classification of bank activities.

Illiquid assets	***0.5**
Loans	Retail Customers, Real Estate Mortgages, Corporate entities, SMEs, Governmental and public sector, Other loans
Fixed Assets	Land, Buildings, Equipment, furniture and fixtures, Vehicles, Computer, Other fixed assets
Intangible Assets	Goodwill, Other intangible assets
Investments in Affiliates &	Quoted Financial Assets, Unquoted Financial Assets
Financial assets at fair value through other comprehensive income	
Other Assets	Accrued revenues and interest, Prepaid expenses, Assets seized by the Bank, Assets seized by the Bank with customer right to recover, Cheques under collection, Other
Liquid assets	***-0.5**
Cash	Cash in treasury Balances at central banks
Balances at banks and Financial Institutions	Current accounts and demand deposits Deposits maturing within or less than 3 months Other
Deposits at Banks and Financial Institutions	Deposits Maturing (3-6) and (6-month -1 Year) other
Trading Investments	Shares listed on financial markets
	Bonds listed on financial market
Available for sale Investments	Shares
	Bonds
	Investment funds
Held to maturity investments	Treasury bills
	Governmental bonds or
	government guaranteed bonds
	Company bonds and debentures Other
Liquid liabilities	***0.5**
Deposits	Banks and Financial Institutions Deposits
	Customers' Deposits
	Other deposits
Illiquid liabilities	***-0.5**
Loan and Borrowing	Borrowing from the Central Bank of Jordan

	Other loans and Borrowing
Other Liabilities	Other liabilities
Equity	***-0.5**
Total Shareholders' equity	Paid-in capital
	Reserves
	Foreign Currency Translation reserve
	Revalution reserve for financial assets
	Retained Earnings and Proposed Dividends
	Other equity

Our collection of dependent variables include provisioning for loan losses that capture the quality of bank assets (Cebenoyan and Strahan, 2004, Athanasoglou et al., 2014, and Lee and Hsieh, 2013). Hence, the riskier banks' assets are the higher the ratio of loan loss provisioning. Z-score is used to calculate bank risk, with the hypothesis that z-score value and bank stability are positively correlated (Athanasoglou et al., 2014, Houston et al. 2010, Laeven and Levine, 2009, and Ramayandi et al., 2014). To break down the cross effects amongst risk proxies, we multiply the values for banks' z- scores by −1, such that a higher value indicates greater risk in all instances. The following models 6.2 - 6.5 analyze the impact of the leading independent variable liquidity funding risk Dep on Jordanian commercial banks liquidity creation LC, bank risk-weighted assets RWA, loan loss provisions LLP, and z-score. The models also include a set of control variables. t refers to the time span from 2003 to 2017, and i denotes the number of banks 13, G refers to country fixed effects and u is the error term.

$$LC_{it} = \alpha + \beta_1 Dep_{it} + \beta_2 Loan_{it} + \beta_3 Asset_{it} + \beta_4 ROA_{it} + \beta_5 ROE_{it} + \beta_6 CAP_{it} + \beta_7 NPL_{it} + \beta_8 IRB_t + \beta_9 IRL_t + \beta_{10} MIR_t + \beta_{11} GDP_t + \beta_{12} INF_t + \beta_{13} UNM_t + \beta_{14} GFC_t + G_i + u_{it} \quad (7.2)$$

$$LLP_{it} = \alpha + \beta_1 Dep_{it} + \beta_2 Loan_{it} + \beta_3 Asset_{it} + \beta_4 ROA_{it} + \beta_5 ROE_{it} + \beta_6 CAP_{it} + \beta_7 NPL_{it} + \beta_8 IRB_t + \beta_9 IRL_t + \beta_{10} MIR_t + \beta_{11} GDP_t + \beta_{12} INF_t + \beta_{13} UNM_t + \beta_{14} GFC_t + G_i + u_{it} \quad (7.3)$$

$$RWA_{it} = \alpha + \beta_1 Dep_{it} + \beta_2 Loan_{it} + \beta_3 Asset_{it} + \beta_4 ROA_{it} + \beta_5 ROE_{it} + \beta_6 CAP_{it} + \beta_7 NPL_{it} + \beta_8 IRB_t + \beta_9 IRL_t + \beta_{10} MIR_t + \beta_{11} GDP_t + \beta_{12} INF_t + \beta_{13} UNM_t + \beta_{14} GFC_t + G_i + u_{it} \quad (7.4)$$

$$Z - score_{it} = \alpha + \beta_1 Dep_{it} + \beta_2 Loan_{it} + \beta_3 Asset_{it} + \beta_4 ROE_{it} + \beta_5 NPL_{it} + \beta_6 IRB_t + \beta_7 IRL_t + \beta_8 MIR_t + \beta_9 GDP_t + \beta_{10} INF_t + \beta_{11} UNM_t + \beta_{12} GFC_t + G_i + u_{it} \quad (7.5)$$

In order to test the impact of introducing the deposit insurance scheme on bank capital and liquidity creation, Model 6.7 is then developed to estimate coefficients of the ratio of LC/TA on a group of variables including CAP ratio and bank-specific factors. We estimate Model 6.7 using data before and after the introduction of deposit insurance scheme in 2000. Deposit insurance is assumed to decrease the liquidity creating role in influencing bank risks (Allen and Gale, 2004) based on the "risk absorption" hypothesis. Another hypothesis "financial fragility/crowding out" states that deposit insurance schemes do not reduce liquidity creation because insured deposits are less likely to be withdrawn. Differenced values are used for all independent variables to mitigate the potential endogeneity problem following (Berger and Bouwman, 2009). This model is estimated using the Difference in Difference (DiD) approach as follows:

$$\Delta Y_{it} = \emptyset \Delta \mathrm{T}_{it} + \delta \Delta X_{it} + \Delta \varepsilon_{it} \quad (7.6)$$

where Y_{it} is the dependent variable (liquidity creation), $\emptyset$ estimate the unbiased effect of the program, T is the treatment dummy variable (deposit insurance scheme), when T=1 the individual *i* is participant of the treatment, and T= 0 if non-participant. δ is the coefficient of the independent variables and the ε is the error term. Applying the general DiD specification, we develop Model 6.7 as follows:

$$\Delta LC_{it} = \alpha + \beta_1 \Delta Dep_{it} + \beta_2 \Delta Loan_{it} + \beta_3 \Delta Asset_{it} + \beta_4 \Delta ROA_{it} + \beta_5 \Delta ROE_{it} + \beta_6 \Delta CAP_{it} + \beta_7 \Delta NPL_{it} + \beta_8 \Delta JDIC_t + u_{it} \quad (7.7)$$

Our analysis also identifies the main determinants of funding liquidity risk. Deposits, in general, are used to measure banks' funding liquidity risks. Higher bank deposits are hypothesized to reduce funding liquidity risk (Acharya and Naqvi, 2012). However, in some instances and due to the deposit insurance, banks with larger deposits are found to be engaged in riskier decisions. Model 6.8 is used to analyze the impact of selected variables on the Jordanian commercial banks funding liquidity risk:

$$Dep_{it} = \alpha + \beta_1 Loan_{it} + \beta_2 Asset_{it} + \beta_3 ROA_{it} + \beta_4 ROE_{it} + \beta_5 CAP_{it} + \beta_6 NPL_{it} + \beta_7 IRB_t + \beta_8 IRL_t + \beta_9 MIR_t + \beta_{10} GDP_t + \beta_{11} INF_t + \beta_{12} UNM_t + \beta_{13} GFC_t +$$

$$G_i + u_{it} \quad (7.8)$$

Amongst the set of control variables in our models we use capital (CAP), where well-capitalized banks are found to have low-risk assets portfolio (Altunbas et al., 2007). Bank Profitability is used as a performance measure, in which it is generally perceived to have a positive effect on bank capital via increasing the retained earnings and capital (Rime, 2001). Bank size is found to have a negative association with the volatility of asset returns (Boyd and Runkle, 1993). According to the theory, loans are found to be associated with higher rates of deposit funding. While high levels of non-performing loans are found to be associated with higher capital buffer and risk levels. Our set of control variables also includes GDP growth, inflation, unemployment, interest rates on interbank transactions, loans and monetary policy interest rate. We also use a dummy variable to capture the impact of the 2008 global financial crises.

Table 7 5Empirical results of Pooled OLS, FE of the Jordanian commercial banks liquidity creation (2003-2015)

VARIABLES	(LC) Pooled OLS	(LC) GLS	(LC) FE
LDep	0.2084	0.2084	-0.1078
	-0.1365	-0.1365	-0.1576
LLoan	.4258***	.4258***	.2421***
	-0.0793	-0.0793	-0.0805
LAsset	-0.5559	-0.5559	11.0215
	-1.6180	-1.6180	-8.2413
LROA	-2.5800	-2.5800	-0.1779
	-2.1158	-2.1158	-1.9986
LROE	0.1527	0.1527	-0.2271
	-0.2524	-0.2524	-0.2395
LCAP	-0.3604	-0.3604	0.1442
	-0.3544	-0.3544	-0.3641
LNPL	-.0201***	-.0201***	-0.0035
	-0.0072	-0.0072	-0.0074
LIRB	-0.0746	-0.0746	-0.3938
	-1.5853	-1.5853	-1.3753
LIRL	1.1535	1.1535	2.4794
	-3.5421	-3.5421	-3.2745
LMIR	0.5858	0.5858	-0.6839
	-1.6032	-1.6032	-1.5095
LGDP	0.4523	0.4523	1.0026
	-0.7869	-0.7869	-0.7442
LINF	-0.1487	-0.1487	-0.1366
	-0.2757	-0.2757	-0.2341
LUNM	-3.3424**	-3.3424**	-0.9880
	-1.4264	-1.4264	-2.0061
LRFC	-2.2822	-2.2822	-2.3850
	-2.3106	-2.3106	-1.9597
Constant	36.6017	36.6017	-82.0588
	-48.6087	-48.6087	-114.8152
Observations	128	128	128
R-squared	0.3575		
Adj R-squared	0.2779		
F	0.0000	0.0000	0.0002
Number of banks	13	13	13

Where the dependent variables are: LC is the Liquidity Creation, LLP is the Loan loss provision, RWA is the Risk-weighted asset, Z-scores is the Z-scores that measured the risk. The independent variables are: Dep is the liquidity funding risk, CAP is the Capitalization, Asset is the Size, ROA and ROE measured the profitability, Loan is the loan, NPL is the None performing loans, IRB is the Interbank Interest Rate, IRL is the Loan Interest Rate, MIR is the Monetary policy interest rate, GDP is the GDP growth rate, UNM is the Unemployment rate, INF is the inflation rate, RFC is the Realized financial crisis, JDIC is the Deposit Insurance Scheme. Note: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 7 6Empirical results of Pooled OLS, FE of the Jordanian commercial banks LLP (2003-2015).

	(LLP)	(LLP)	(LLP)
VARIABLES	**Pooled OLS**	**GLSLS**	**FE**
LDep	-0.0060	-0.0060	0.0060
	-0.0072	-0.0072	-0.0096
LLoan	0.0025	0.0025	-0.0039
	-0.0043	-0.0043	-0.0049
LAsset	.1862*	.1862*	0.4876
	-0.0984	-0.0984	-0.4965
LROA	-.2647**	-.2647**	-.2471**
	-0.1134	-0.1134	-0.1190
LROE	0.0011	0.0011	0.0050
	-0.0135	-0.0135	-0.0143
LCAP	0.0254	0.0254	0.0359
	-0.0193	-0.0193	-0.0220
LNPL	0.0000	0.0000	0.0002
	-0.0004	-0.0004	-0.0005
LIRB	-.2736***	-.2736***	-.2101**
	-0.0844	-0.0844	-0.0824
LIRL	0.0615	0.0615	0.0823
	-0.1905	-0.1905	-0.1994
LMIR	.2042**	.2042**	0.1489
	-0.0860	-0.0860	-0.0915
LGDP	. -.0467617	. -.0467617	-0.0496
	-0.0436	-0.0436	-0.0466
LINF	.0398**	.0398**	.0394***
	-0.0153	-0.0153	-0.0147
LUNM	0.0774	0.0774	0.1278
	-0.0773	-0.0773	-0.1211
LRFC	-0.0294	-0.0294	-0.0160
	-0.1250	-0.1250	-0.1192
Constant	-2.4383	-2.4383	-6.8055
	-2.7005	-2.7005	-6.9636
Observations	124	124	124

R-squared	0.3341		
Adj R-squared	0.2486		
F	0.0000	0.0000	0.0002
Number of banks	13	13	13

Where the dependent variables are: LC is the Liquidity Creation, LLP is the Loan loss provision, RWA is the Risk-weighted asset, Z-scores is the Z-scores that measured the risk. The independent variables are: Dep is the liquidity funding risk, CAP is the Capitalization, Asset is the Size, ROA and ROE measured the profitability, Loan is the loan, NPL is the None performing loans, IRB is the Interbank Interest Rate, IRL is the Loan Interest Rate, MIR is the Monetary policy interest rate, GDP is the GDP growth rate, UNM is the Unemployment rate, INF is the inflation rate, RFC is the Realized financial crisis, JDIC is the Deposit Insurance Scheme. Note: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 7 7Empirical results of Pooled OLS, FE of the Jordanian commercial banks RWA (2003-2015).

	(RWA)	**(RWA)**	**(RWA)**
VARIABLES	**Pooled OLS**	**GLSLS**	**FE**
LDep	-0.1833	-0.2639	-.3235705**
	-0.1949	-0.1750	-0.1562
LLoan	.4977***	.2151**	0.0650
	-0.1136	-0.0924	-0.0811
LAsset	-4.9626**	-3.6682	-35.0218***
	-2.2552	-3.7979	-13.0864
LROA	-0.4959	-2.5253	-3.7208
	-3.4538	-2.7684	-2.4111
LROE	-0.2859	-0.0258	0.1084
	-0.4391	-0.3528	-0.3042
LCAP	0.2262	.90636*	.9328**
	-0.5612	-0.4811	-0.4728
LNPL	-.03264***	-0.0129	-0.0099
	-0.0097	-0.0084	-0.0073
LIRB	-0.7349	0.1362	2.0048
	-2.4893	-1.8014	-1.6275
LIRL	-0.9301	-3.1986	-5.4006
	-9.8834	-7.1200	-5.9779
LMIR	-2.0590	-2.6824	-5.2055**
	-3.9981	-2.8507	-2.5374
LGDP	0.7967	0.5316	0.4961
	-1.4925	-1.0596	-0.8841
LINF	-0.0230	0.0383	0.0255
	-0.5135	-0.3692	-0.3125
LUNM	0.8501	-0.0669	-2.5051

	-3.6958	-2.6311	-2.3136
LRFC	0.1432	0.8414	0.5201
	-4.3363	-3.1028	-2.6282
Constant	113.8762	142.2711	501.6895***
	-121.5409	-95.1537	-152.2763
Observations	110	110	110
R-squared	0.3543		
Adj R-squared	0.2592		
F	0.0001	0.0000	0.0000
Number of banks	13	13	13

Where the dependent variables are: LC is the Liquidity Creation, LLP is the Loan loss provision, RWA is the Risk-weighted asset, Z-scores is the Z-scores that measured the risk. The independent variables are: Dep is the liquidity funding risk, CAP is the Capitalization, Asset is the Size, ROA and ROE measured the profitability, Loan is the loan, NPL is the None performing loans, IRB is the Interbank Interest Rate, IRL is the Loan Interest Rate, MIR is the Monetary policy interest rate, GDP is the GDP growth rate, UNM is the Unemployment rate, INF is the inflation rate, RFC is the Realized financial crisis, JDIC is the Deposit Insurance Scheme. Note: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 7 8Empirical results of Pooled OLS, FE of the Jordanian commercial banks Z-score (2003-2015).

	(Z-score)	(Z-score)	(Z-score)
VARIABLES	**Pooled OLS**	**GLSLS**	**RE**
LDep	-.1814*	-.0703	-.0703
	(.0954)	(.1139)	(.1139)
LLoan	-.0225	-.0743	-.0743
	(.0673)	(.0664)	(.0664)
LAsset	.6306	1.4419	1.4419
	(1.3779)	(2.2147)	(2.2147)
LROE	-.3124***	-.2459**	-.2459**
	(.1035)	(.1054)	(.1054)
LNPL	-.0047	-.0007	-.0007
	(.0061)	(.0063)	(.0063)
LIRB	-2.3452*	-1.9194	-1.9194
	(1.3405)	(1.2148)	(1.2148)
LIRL	2.5483	2.4660	2.4660
	(2.9815)	(1.3171)	(2.6942)
LMIR	1.5203	1.1945	1.3171
	(1.3203)	(0.0936)	(1.1945)
LGDP	.7594	.6379	.6379
	(.6677)	(.6026)	(.6026)

LINF	.19847	.1945	.1945
	(.2351)	(.2107)	(.2107)
LUNM	1.9986*	2.2118**	2.2118**
	(1.1715)	(1.1029)	(1.1029)
LRFC	-1.0533	-1.0062	-1.0062
	(1.9432)	(1.7381)	(1.7381)
Constant	-47.1137	-63.4813	-63.4813
	(37.5145)	(41.3831)	(41.3831)
Observations	130	130	130
R-squared	0.2420		
Adj R-squared	0.1643		
F	0.0007	0.0002	0.0002
Number of banks	13	13	13

Where the dependent variables are: LC is the Liquidity Creation, LLP is the Loan loss provision, RWA is the Risk-weighted asset, Z-scores is the Z-scores that measured the risk. The independent variables are: Dep is the liquidity funding risk, CAP is the Capitalization, Asset is the Size, ROA and ROE measured the profitability, Loan is the loan, NPL is the None performing loans, IRB is the Interbank Interest Rate, IRL is the Loan Interest Rate, MIR is the Monetary policy interest rate, GDP is the GDP growth rate, UNM is the Unemployment rate, INF is the inflation rate, RFC is the Realized financial crisis, JDIC is the Deposit Insurance Scheme. Note: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 7 9Empirical results of Pooled OLS, RE of the Jordanian commercial banks' liquidity funding (2003-2015).

	(Funding Liquidity)	(Funding Liquidity)	(Funding Liquidity)
VARIABLES	**Pooled OLS**	**GLS**	**RE**
LLoan	-.1491***	-.1008**	-.1008**
	(.0509)	(.0438)	(.0438)
LAsset	.4880	1.6575	1.6575
	(1.0444)	(2.7097)	(2.7097)
LROA	2.0854	.0975	.0975
	(1.3969)	(1.1338)	(1.1338)
LROE	-.3275**	-.2553**	-.2553**
	(.1666)	(.1343)	(.1343)
LCAP	-1.3204***	-.7682***	-.7682***
	(.2049)	(.1885)	(.1885)
LNPL	.0005	.0002	.0002
	(.0048) *	(.0041)	(.0041)
LIRB	-1.7440	-1.9643***	-1.9643**
	(1.0549)	(.7776)	(.7776)
LIRL	-3.4454*	-1.8950	-1.8950

	(2.0276)	(1.6613)	(1.6613)
LMIR	1.2916	1.0400	1.0400
	(1.0648)	(.8213)	(.8213)
LGDP	-.5132	-.0209	-.0209
	(.4865)	(.3928)	(.3928)
LINF	.1764	.1153	.1153
	(.1833)	(.1348)	(.1348)
LUNM	-2.1945***	-1.2231	-1.2231
	(.9423)	(.8675)	(.8675)
LRFC	1.3107	.1842	.1842
	(1.4649)	(1.0859)	(1.0859)
Constant	154.6503	110.5548***	110.5548
	(27.4836)	(42.4802)	(42.4802) ***
Observations	143	143	143
R-squared	0.4685		
Adj R-squared	0.4150		
F	0.0000	0.0000	0.0000
Number of banks	13	13	13

Where the dependent variables are: LC is the Liquidity Creation, LLP is the Loan loss provision, RWA is the Risk-weighted asset, Z-scores is the Z-scores that measured the risk. The independent variables are: Dep is the liquidity funding risk, CAP is the Capitalization, Asset is the Size, ROA and ROE measured the profitability, Loan is the loan, NPL is the None performing loans, IRB is the Interbank Interest Rate, IRL is the Loan Interest Rate, MIR is the Monetary policy interest rate, GDP is the GDP growth rate, UNM is the Unemployment rate, INF is the inflation rate, RFC is the Realized financial crisis, JDIC is the Deposit Insurance Scheme. Note: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.

Table 7 10Empirical results of GLS, FE, and RE of the Jordanian commercial banks (liquidity creation, loan loss provision, risk weighted assets, and z-score) for the period 2003-2006.

	LC			LLP			Z-score		
VARIABLES	**OLS**	**GLS**	**RE**	**OLS**	**GLS**	**RE**	**OLS**	**GLS**	**RE**
LDep	1.0005**	.3934	.3934	-.0143	-.0143	-.0143	-.0594	-.0594	-.0594
	(.3611)	(.4589)	(.4589)	(.0221)	(.0221)	(.0221)	(.1035)	(.1035)	(.1035)
LLoan	1.2349***	.5638	.5638	-.0250	-.0250	-.0250	-.1627	-.1627	-.1627
	(.3054)	(.3984)	(.3984)	(.0193)	(.0193)	(.0193)	(.1039)	(.1039)	(.1039)
LAsset	9.2836*	3.8092	3.8092	-.6013*	-.6013*	-.6013*	-3.1601*	-3.1601*	-3.1601*
	(5.2071)	(9.1444)	(9.1444)	(.3331)	(.3331)	(.3331)	(1.8441)	(1.8441)	(1.8441)
LROA	-5.7465*	-3.9550	-3.9550	.0305	.0305	.0305			
	(3.3924)	(2.7664)	(2.7664)	(.2115)	(.2115)	(.2115)			
LROE	.65906	.4775	.4775	-.0215	-.0215	-.0215	-.0764	-.0764	-.0764
	(.3394)	(.2992)	(.2992)	(.0212)	(.0212)	(.0212)	(.0576)	(.0576)	(.0576)
LCAP	.61092	.1323	.1323	-.0141	-.0141	-.0141			
	(.8584)	(.7400)	(.7400)	(.0516)	(.0516)	(.0516)			
LNPL	.1899	.1070	.1070	-.0032	-.0032	-.0032	.0297	.0297	.0297
	(.1900)	(.18343)	(.18343)	(.01190)	(.01190)	(.01190)	(.0646)	(.0646)	(.0646)
Constant	-193.0002**	-65.8450	-65.8450	8.1909	8.1909	8.1909	36.0536	36.0536	36.0536
	(66.007)	(104.2056)	(104.2056)	(4.14026) *	(4.14026) *	(4.14026) *	(20.9211)	(20.9211)	(20.9211)
Observations	23	23	23	23	23	23	24	24	24
R-squared	0.6465			0.4096			0.4572		
Adj R-squared	0.4815			0.1340			0.3064		
F	0.0126			0.2451			0.0370		
Prob > chi2		0.7574	0.7574		0.1668	0.1668		0.0097	0.0097

Number of banks	13	13	13	13	13	13	13	13	13

Where the dependent variables are: LC is the Liquidity Creation, LLP is the Loan loss provision, RWA is the Risk-weighted asset, Z-scores is the Z-scores that measured the risk. The independent variables are: Dep is the liquidity funding risk, CAP is the Capitalization, Asset is the Size, ROA and ROE measured the profitability, Loan is the loan, NPL is the None performing loans. Note: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 7 11Empirical results of GLS, FE, and RE of the Jordanian commercial banks (liquidity creation, loan loss provision, risk weighted assets, and z-score) for the period 2007-2009.

	LC			LLP			RWA			Z-score		
VARIABLES	**OLS**	**GLS**	**RE**	**OLS**	**GLS**	**FE**	**OLS**	**GLS**	**FE**	**OLS**	**GLS**	**RE**
LDep	0.2754	0.2177	0.2177	-0.0103	-0.0103	.0823 **	-.4501**	-.4501**	-0.5061	-0.0199	-0.0265	-0.0265
	-0.2090	-0.2205	-0.2205	-0.0167	-0.0167	-0.0337	-0.2154	-0.2154	-0.4158	-114253	-0.1235	-0.1235
LLoan	0.2499	0.1517	0.1517	0.0050	0.0050	-0.0271	.4727**	.4727**	0.1122	0.0294	-0.0059	-0.0059
	-0.1666	-0.1526	-0.1526	.0127681)	.0127681)	-0.0171	-0.1781	-0.1781	-0.2355	-0.0891	-0.0896	-0.0896
LAsset	-0.7423	-0.1830	-0.1830	0.3640	0.3640	1.9264	-12.1214***	-12.1214***	31.4667	-1.6149	-1.3223	-1.3223
	-2.7034	-3.2381	-3.2381	-0.3918	-0.3918	-2.6136	-2.8770	-2.8770	-35.1219	-1.6978	-1.9756	-1.9756
LROA	-2.2277	-2.0044	-2.0044	-0.4324	-0.4324	-0.3815	-3.9372	-3.9372	-6.2448			
	-3.1179	-3.3827	-3.3827	-0.2723	-0.2723	-0.5497	-3.3191	-3.3191	-7.3269			
LROE	0.1282	0.1091	0.1091	0.0330	0.0330	.0946*	-0.4822	-0.4822	-0.2600	-.3018 *	-0.1834	-0.1834
	-0.4775	-0.4363	-0.4363	-0.0381	-0.0381	-0.0459	-0.5100	-0.5100	-0.6095	-0.1633	-0.1756	-0.1756
LCAP	-0.1803	0.0001	0.0001	0.0701	0.0701	.1678**	-0.0387	-0.0387	0.8172			
	-0.6613	-0.6289	-0.6289	-0.0516	-0.0516	-0.0692	-0.7068	-0.7068	.9106676)			
LNPL	-.0422***	-.0277**	-.0277**	-0.0001	-0.0001	-0.0003	-.0631***	-.0631***	-.0516**	-.0168**	-.0178**	-.0178**
	-0.0110	-0.0113	-0.0113	-0.0009	-0.0009	-0.0013	-0.0117	-0.0117	-0.0181	-0.0071	-0.0076	-0.0076
Constant	9.8244	10.3447	10.3447	-3.0101	-3.0101	-24.5666	202.9984***	202.9984***	-186.5980	13.5733	11.7018	11.7018
	-29.2461	-32.7190	-32.7190	-3.3775	-3.3775	-23.4603	-30.5156	-30.5156	-321.6626	-17.6050	-19.7902	-19.7902

Observations	31	31	31	28	28	28	32	32	32	32	32	32
R-squared	0.5330			0.3498			0.7759			0.2861		
Adj R-squared	0.3909			0.1222			0.7106			0.1488		
F	0.0075			0.2117			0.0000			0.0997		
Prob > chi2		0.1658	0.1658		0.1495	0.2038		0.0000	0.0745		0.2067	0.2067
Number of banks	13	13	13	13	13	13	13	13	13	13	13	13

Where the dependent variables are: LC is the Liquidity Creation, LLP is the Loan loss provision, RWA is the Risk-weighted asset, Z-scores is the Z-scores that measured the risk. The independent variables are: Dep is the liquidity funding risk, CAP is the Capitalization, Asset is the Size, ROA and ROE measured the profitability, Loan is the loan, NPL is the None performing loans. Note: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 7 12Empirical results of GLS, FE, and RE of the Jordanian commercial banks (liquidity creation, loan loss provision, risk weighted assets, and z-score) for the period 2010-2015.

	LC			LLP			RWA			Z-score		
VARIABLES	**OLS**	**GLS**	**RE**	**OLS**	**GLS**	**FE**	**OLS**	**GLS**	**RE**	**OLS**	**GLS**	**RE**
LDep	0.0095	0.0095	0.0095	0.0087	0.0086	0.0042	0.0845	0.0809	0.0809	-.3024*	-0.2583	-0.2583
	-0.1982	-0.1982	-0.1982	-0.0107	-0.0111	-0.0130	-0.2948	-0.2024	-0.2024	-0.1783	-0.1793	-0.1793
LLoan	.3998***	.3998***	.3998***	0.0029	0.0003	-0.0082	.5155***	-0.0041	-0.0041	. .0312895	-0.0653	-0.0653
	-0.1037	-0.1037	-0.1037	-0.0056	-0.0058	-0.0070	-0.1528	-0.1042	-0.1042	-0.1048	-0.1031	-0.1031
LAsset	-2.2590	-2.2590	-2.2590	0.2494	0.2374	-1.3479*	-2.6420	-3.6662	-3.6662	2.1020	2.4421	2.4421
	-1.9742	-1.9742	-1.9742	-0.1119	-0.1311	-0.7256	-2.8885	-4.5362	-4.5362	-2.0078	-3.5796	-3.5796
LROA	-3.5205	-3.5205	-3.5205	-0.2959	-0.3492	-0.3694	3.5013	-3.8042	-3.8042			
	-5.6255	-5.6255	-5.6255	-0.3038	-0.3124	-0.3586	-8.1480	-5.4190	-5.4190			
LROE	0.4479	0.4479	0.4479	-0.0142	-0.0076	-0.0067	-0.6770	0.4961	0.4961	-.5763**	-.5492**	-.5492**
	-0.7696	-0.7696	-0.7696	-0.0415	-0.0429	-0.0484	-1.1138	-0.7446	-0.7446	-0.2307	-0.2601	-0.2601
LCAP	-0.6811	-0.6811	-0.6811	0.0152	0.0183	-0.0147	0.3377	1.2787**	1.2787**			
	-0.5778	-0.5778	-0.5778	-0.0313	-0.0325	-0.0442	-0.8377	-0.6024	-0.6024			

LNPL	-0.0125	-0.0125	-0.0125	0.0001	0.0001	0.0003	-.0231*	0.0010	0.0010	-0.0035	0.0017	0.0017
	-0.0086	-0.0086	-0.0086	-0.0005	-0.0005	-0.0005	-0.0124	-0.0078	-0.0078	-0.0088	-0.0080	-0.0080
Constant	42.7662	42.7662	42.7662	-2.2853	-2.0916	13.8115*	61.4762	78.9640*	78.9640*	-2.4658	-5.0977	-5.0977
	-27.6643	-27.6643	-27.6643	-1.5232	-1.6713	-7.0767	-39.9898	-47.2200	-47.2200	-23.6546	-35.5336	-35.5336
Observations	74	74	74	73	73	73	72	72	72	74	74	74
R-squared	0.2674			0.2546			0.2219			0.1603		
Adj R-squared	0.1897			0.1743			0.1368			0.0986		
F	0.0034			0.0060			0.0197			0.0330		
Prob > chi2		0.0011	0.0011		0.0090	0.0175		0.3554	0.3554		0.1804	0.1804
Number of banks	13	13	13	13	13	13	13	13	13	13	13	13

Where the dependent variables are: LC is the Liquidity Creation, LLP is the Loan loss provision, RWA is the Risk-weighted asset, Z-scores is the Z-scores that measured the risk. The independent variables are: Dep is the liquidity funding risk, CAP is the Capitalization, Asset is the Size, ROA and ROE measured the profitability, Loan is the loan, NPL is the None performing loans. Note: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 7 13Empirical Results of GLS, RE, and FE of the Jordanian commercial liquidity funding.

	2003-2006			2007-2009			2010-2015		
VARIABLES	**OLS**	**GLS**	**RE**	**OLS**	**GLS**	**RE**	**OLS**	**GLS**	**RE**
Loan	-.3322***	-.1698*	-.1698*	-.4619***	-.2472	-.2472	0245	.0713	.0713
	(.1171)	(.0882)	(.0882)	(.1555)	(.1690)	(.1690)	(.0628)	(.0602)	(.0602)
Asset	2.4704	-6.8010	-6.8010	.20697	1.4359	1.4359	-.0332	-.1883	-.1883
	(4.3749)	(1.0444)	(1.0444)	(1.6413)	(2.3082)	(2.3082)	(1.2154)	(2.1694)	(2.1694)
ROA	-1.0615	-1.1233	-1.1233	.1038	-1.1362	-1.1362	-.9149	-8.0491*	-8.0491*
	(2.6256)	(1.3342)	(1.3342)	(2.1375)	(2.2177)	(2.2177)	(5.2607)	(4.5369)	(4.5369)

ROE	-.0311	.0251	.0251	.0703	-.0368	-.0368	.3917	1.1994*	1.1994*
	(.2706)	(.1504)	(.1504)	(.3160)	(.3255)	(.3255)	(.7422)	(.6442)	(.6442)
CAP	-.8316	-.6316**	-.6316**	-1.1010***	-1.1498	-1.1498***	-.8496*	-.3432	-.3432
	(.5370)	(.3166)	(.3166)	(.3722)	(.4105)	(.4105)	(.4515)	(.4208)	(.4208)
NPL	.0201	-.0034	-.0034	-.0084	-.0016	-.0016	-.0028	-.0049	-.0049
	(.1225)	(.1002) *	(.1002) *	(.0075)	(.0078)	(.0078)	(.0052)	(.0045)	(.0045)
Constant	77.3627**	151.425***	151.425***	108.0863***	89.9315***	89.9315***	83.8535***	77.9510***	77.9510***
	(35.8412)	(38.3463)	(38.3463)	(17.3922)	(23.8700)	(23.8700)	(13.6695)	(21.9078)	(21.9078)
Observations	34	34	34	33	33	33	76	76	76
R-squared	0.6367			0.7120			0.2901		
Adj R-squared	0.5559			0.6456			0.2283		
F	0.0001			0.0000			0.0005		
Prob > chi2		0.0000	0.0000		0.0002	0.0002		0.0003	0.0003
Number of banks	13	13	13	13	13	13	13	13	13

Where the dependent variables are: Dep is the Liquidity funding risk. The independent variables are: CAP is the Capitalization, Asset is the Size, ROA and ROE measured the profitability, Loan is the loan, NPL is the None performing loans. Note: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 7 14A Empirical results for the impact of the deposit insurance scheme on the Jordanian banking liquidity creation using DID approach for the period (1995-2015).

VARIABLES	D.LC (Pooled)	D.LC (FE)
D.Dep	0.420***	0.416***
	(0.121)	(0.125)
D.Loan	0.358***	0.358***
	(0.0463)	(0.0474)
D.Asset	-12.39*	-13.79*
	(6.823)	(7.299)
D.ROA	1.969***	1.966***
	(0.619)	(0.633)
D.ROE	-0.0888	-0.0884
	(0.0690)	(0.0706)
D.CAP	-0.541***	-0.538***
	(0.109)	(0.112)
D.NPL	0.0080	0.0079
	(0.0068)	(0.0069)
D.JDIC	-4.441**	-4.373**
	(2.053)	(2.102)
Constant	1.122**	1.183**
	(0.549)	(0.569)
Observations	254	254
R-squared	0.389	0.389
Number of Bank	13	13

Where the dependent variables is: LC is the Liquidity Creation that measured the risk. The independent variables are: Dep is the liquidity funding risk, CAP is the Capitalization, Asset is the Size, ROA and ROE measured the profitability, Loan is the loan, NPL is the None performing loans, JDIC is the Deposit Insurance Scheme. Note: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 7 15B Empirical results of the impact of the deposit insurance scheme on the Jordanian banking liquidity creation using DID approach for the period (1995-2015).

	(OLS)	(FE)
VARIABLES	**D.LC**	**D.LC**
D.Dep	**0.508*** **	**0.510*** **
	(0.0741)	**(0.0761)**
D.Loan	**0.553*** **	**0.549*** **
	(0.0346)	**(0.0353)**
D.Ass	**-5.352**	**-9.054**
	(6.437)	**(7.476)**
D.ROA	**1.844** **	**1.866** **
	(0.826)	**(0.842)**
D.ROE	**-0.215** **	**-0.217** **
	(0.101)	**(0.103)**
D.CAP	**-0.440*** **	**-0.441*** **
	(0.127)	**(0.131)**
D.NPL	**0.00134**	**0.00138**
	(0.00326)	**(0.00331)**
Constant	**0.380**	**0.554**
	(0.420)	**(0.458)**
Observations	**130**	**130**
R-squared	**0.719**	**0.733**
Number of Bank		**13**

Where the dependent variables is: LC is the Liquidity Creation that measured the risk. The independent variables are: Dep is the liquidity funding risk, CAP is the Capitalization, Asset is the Size, ROA and ROE measured the profitability, Loan is the loan, NPL is the None performing loans, Scheme. Note: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 7 16 A The impact of the deposit insurance on the Jordanian Banking Liquidity Creation using DID approach for the pre and post-period of the scheme.

	2000-2015		1995-1999	
	Pooled OLD	FE	Pooled OLD	FE
VARIABLES	D.LC	D.LC	D.LC	D.LC
D.Dep	0.414***	0.420***	0.955***	0.964***
	(0.129)	(0.133)	(0.176)	(0.210)
D.Loan	0.345***	0.344***	0.805***	0.772***
	(0.0487)	(0.0502)	(0.116)	(0.137)
D.Ass	-16.17*	-17.62*	-25.29***	-33.28***
	(9.089)	(9.937)	(8.124)	(10.34)
D.ROA	1.834***	1.803***	1.833	1.767
	(0.654)	(0.675)	(2.224)	(3.146)
D.ROE	-0.0811	-0.0817	-0.129	-0.103
	(0.0736)	(0.0756)	(0.189)	(0.248)
D.CAP	-0.538***	-0.526***	-0.540***	-0.693***
	(0.129)	(0.134)	(0.180)	(0.239)
Constant	1.462**	1.524**	1.350**	1.784**
	(0.641)	(0.673)	(0.591)	(0.716)
Observations	193	193	47	47
R-squared	0.400	0.404	0.749	0.758
Number of Bank		13		13

Where the dependent variables is: LC is the Liquidity Creation that measured the risk. The independent variables are: Dep is the liquidity funding risk, CAP is the Capitalization, Asset is the Size, ROA and ROE measured the profitability, Loan is the loan, NPL is the None performing loans, JDIC is the Deposit Insurance Scheme. Note: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 7 17B: The impact of the deposit insurance on the Jordanian Banking Liquidity Creation using DID approach for the pre and post-period of the scheme.

	2000-2015		1995-1999	
	Pooled OLD	FE	Pooled OLD	FE
VARIABLES	D.LC	D.LC	D.LC	D.LC
D.Dep	0.508***	0.510***	0.508***	0.510***
	(0.0741)	(0.0761)	(0.0741)	(0.0761)
D.Loan	0.553***	0.549***	0.553***	0.549***
	(0.0346)	(0.0353)	(0.0346)	(0.0353)
D.Ass	-5.352	-9.054	-5.352	-9.054
	(6.437)	(7.476)	(6.437)	(7.476)
D.ROA	1.844**	1.866**	1.844**	1.866**
	(0.826)	(0.842)	(0.826)	(0.842)
D.ROE	-0.215**	-0.217**	-0.215**	-0.217**
	(0.101)	(0.103)	(0.101)	(0.103)
D.CAP	-0.440***	-0.441***	-0.440***	-0.441***
	(0.127)	(0.131)	(0.127)	(0.131)
D.JDIC	0.00134	0.00138	0.00134	0.00138
	(0.00326)	(0.00331)	(0.00326)	(0.00331)
Constant	0.380	0.554	0.380	0.554
	(0.420)	(0.458)	(0.420)	(0.458)
Observations			130	130
R-squared	0.719	0.733	0.719	0.733
Number of Bank		13		13

Where the dependent variables is: LC is the Liquidity Creation that measured the risk. The independent variables are: Dep is the liquidity funding risk, CAP is the Capitalization, Asset is the Size, ROA and ROE measured the profitability, Loan is the loan, NPL is the None performing loans, JDIC is the Deposit Insurance Scheme. Note: Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

7.5 Results

The analysis employed several econometric approaches to address the study questions and to ensure the robustness of the results. These methods include Pooled OLS, FE, RE, in addition to use different measure of risk. The selection between FE and GLS models is based on Hausman test results. The test confirms that FE model is more appropriate for the first three models (LC, LLP, and RWA) while GLS model is more appropriate for the last model (Z-score). Due to a large number of results, as a rule of thumb, we report only the results that are significant and robust across at least two of the estimations methodologies. The ratio of total

equity to total assets (CAP) is significant and positively correlated with RWA (credit risk) with a coefficient of 0.93 suggesting that Jordanian banks with larger capital engage in more risky actions than other banks (Table 7.7). Size is positively correlated with risk-weighted assets with a coefficient of 35.02 indicating that the size of the bank increased its credit risk (Table 7.7). The results are in line with the findings of (Boyd and Runkle, 1993), (Demsetz and Strahan, 1997), and (De Haan and Poghosyan, 2012). There is a significant robust positive relationship between loan and liquidity creation as shown in Table 7.5. This result is consistent with the implications of short-term liquidity for bank risk-taking and bank stability, the theoretical predictions of (Acharya and Naqvi, 2012) and (Wagner, 2007) suggest that high levels of asset liquidity can potentially increase bank risk. Deposits shield banks from "run" risk and banks with higher deposits have less funding liquidity risk, which in turn reduces market discipline and leads to greater risk-taking by banks and the findings of (Acharya and Naqvi's, 2012) who note that increased deposit funding increased both liquidity creation and risk-weighted assets. NPL negatively affect liquidity creation, where one unit increase in the rate of NPL, reduces LC by -0.020 in the FE model in Table 7.5. The estimation results show that MIR has a significant positive relationship with LLP. One unit increase in MIR leads to 0.20 increase in the LLP. The low-interest-rate in the Jordanian banking reduces the volume of bank deposits that feeds into lower risk levels.

ASS, MIR, and INF are positively correlated with banks' loan loss prevention, while ROA and IRB are the negative regressors. Loan is positively correlated with liquidity creation as shown in Table 7.5. This result suggests that the excessive lending behavior of Jordanian commercial banks increases the chances of credit and default risks. In line with (Acharya and Naqvi's, 2012) who showed that increasing deposit funding increased both liquidity creation and risk-weighted assets. Both ROA and ROE have a negative relationship with loan loss provisions and z-score. In Table 7.6, for example, a one-unit increase in ROA decreases LLP with a coefficient value of 0.247. High capital adequacy ratios and high profits enhance banks' capacity to increase provisions and mitigate potential losses out of any financial shocks. Interbank interest rates are shown to reduce bank risk as captured by LLP in Table 7.6. This finding is in line with (Khan et al., 2017). Unemployment and inflation feed into higher bank risks as shown in Tables 7.6 and 7.8. Macroeconomic imbalances adversely affect individuals' credit profile and make them less likely to repay their obligations to the banks which directly increase banks' risk.

Turning to results for the liquidity funding risk model shown in Table 7.9, the results

show that there is a significant negative relationship between loan, ROE, CAP, IRB and funding liquidity risk with coefficients of 0.10, 0.25, 0.76, and 1.96 respectively. These findings suggest that an increase in the capital buffer and profit decrease liquidity funding risk and are in line with previous results that confirm that well-capitalized banks with high-profit profiles are better protected against shocks (Jeitschko and Jeung, 2005) the results in line with results of (Tan and Floros, 2013) in the context of the Chinese banking industry and suggested by the financing theory, high levels of debt and low value of equity to asset ratio results in high risk.

Theoretically, the relationship between the liquidity of bank assets and banking stability modelled by (Wagner, 2007) who finds that during financial crises but not during normal times increased liquidity of bank assets reduces banking stability. In line with our results. Tables 7.10 - 7.12 displays the results for the 3 sub-periods: before, during and after the global financial crises. The results show that before the 2008 crises, size negatively impacted the Jordanian banking sector risk-taking (LLP and z-score) with a coefficient of 0.60 and 3.16 respectively (Table 7.10). The results indicate that the larger Jordanian banks are safer and more stable in line with (Boyd and Runkle, 1993), (Demsetz and Strahan, 1997), and (De Haan and Poghosyan, 2012). During the global financial crises, NPL is shown to have a negative and significant impact on the Jordanian banking sector risk-taking (LC, RWA, and Z-score) behaviour with a coefficient of 0.02, 0.05, and 0.01 respectively.

Dep, ROE, and CAP are positively correlated with the Jordanian banking sector risk-taking (LLP) with coefficients of 0.08, 0.09, and 0.16 respectively. The results are explained by the fact that Jordanian banks with high capital buffers engage in much riskier activities. These results also correspond with the capital adequacy ratio (CAR) levels in the Jordanian banking sector, ranging between 18.0 percent and 21.0 percent during the years 2007-2015. The CAR levels are generally higher by a comfortable margin than the limit set by the CBJ of 12.0 percent and the limit specified by Basel Committee of 8.0 percent. The CAR increased to 19.1 percent at the end of 2015. The results also show that after the global financial crises, the loan and CAP has positive significant impacts on the Jordanian banking sector risk levels.

In regard to the liquidity funding risk model in Table 7.13, the results show that before the global financial crises, loan and CAP have a negative significant impact on the funding liquidity risk with coefficients of 0.16 and 0.63 respectively. While during the global financial crises, CAP maintains its negative relationship with the liquidity funding risk with a coefficient

of 1.14. The results suggest that increasing capital buffer and bank profits decrease the liquidity funding risk. ROA has a significant negative impact on the funding liquidity risk with a coefficient of 8.04, in the period that followed the global financial crisis. It is worth mentioning that the rate of return on assets (ROA) in Jordan's banking system also witnessed a sharp decline in the 2006-2010 period that include and also followed the global financial crises. ROA rates reached 1.7 percent at the end of 2006 and declined to 1.1% at the end of 2009.

Table 7.14 shows the DiD estimation results of the impact of the deposit insurance scheme on Jordanian commercial bank liquidity creation during the period 1995-2015. While Table 7.15 reports the estimation results during two sub-periods, before (1995-1999) and after (2000-2015) the system implementation. The result show that in general banks enrolled in the deposit insurance scheme have a significant decrease of a value 4.37 on the rates of liquidity creation. The sign remains negative in describing the relationship between deposit insurance and the impact of capital on liquidity creation during the 2 sub-periods.

Theoretically, lower funding liquidity risk can induce bank managers to engage in more aggressive lending practices as shown by (Acharya and Naqvi, 2012) who present this theoretical evidence. In line with this view, banks with greater access to deposit funding during the financial crisis were willing to lend more than those that relied more on short-term debt financing as shown by (Ivashina and Scharfstein, 2010). Similarly, (Wagner, 2007) show that higher liquidity can increase banking system instability. our results show that liquidity funding, loan, and ROA have significantly positive relationships with liquidity creation. The results suggest that in the presence of the deposit insurance scheme, banks with excessive deposits have less liquidity funding risk which in turn reduces the probability of bank runs. While those Jordanian banks' that lend more are typically riskier. Ass and CAP improve liquidity creation with coefficients of 13.79 and 0.53, respectively, suggesting that Jordanian banks with higher capital buffers tend to take less risk relative to banks with lower capital buffers. The major finding is that the "financial fragility/crowding out" hypothesis explains better our findings in relation to the negative relationship between bank capital and liquidity creation variable. The analysis provides robust evidence support the negative relationship between capital and liquidity creation before and during the implementation of the deposit insurance scheme for the Jordanian banking system. In other words, greater liquidity creation leads to lower levels of capital. the explanation of this finding that the increased liquidity creation is associated with increased deposits that crowd out capital in Jordanian banks especially after the huge amount of refugee deposits during the Arab spring for the (Iraqi and Syrian refugees). The interest rate

that paid on the deposit fluctuates between 3 and 5 percent during the study period which is a safe investment for the individuals. This improvement of the depositor access leads to reduces the incentives for bank managers to search for external funding, including the capital. We can interpret this finding because of the improved access to the depositor base would reduce the incentives for Jordanian commercial banks managers to search for external funding, including the capital. Our results in line with (Berger and Bouwman, 2009) and F(ungáčová et al., 2010) who find a negative impact from the capital on liquidity creation. A negative impact of capital on liquidity creation would the results suggest that greater capital requirements may hamper liquidity creation noting that the Jordanian banks hold greater than the minimum of the capital requirement (reach 21% during the study period).

7.6 Summary and Conclusion

The aim of this chapter is to study the impact of banks' funding liquidity risk on the Jordanian commercial banks' risk-taking behavior using panel data of 13 commercial banks and covering the period 2003-2015. We use fixed and random effects estimation methodologies to empirically define the main determinants of the different risk measures of the Jordanian commercial banks. The analysis extends to determine also the major factors of the bank's liquidity funding. DiD method is used to analyze the impact of implementing the deposit insurance scheme in 2000 on Jordanian banks' liquidity creation. This chapter attempts to address the following research questions, 1) does size affect liquidity funding? 2) does capitalization affect liquidity funding? 3) do crises periods affect liquidity funding? 4) does size affect liquidity creation? 5) does capitalization affect liquidity creation? and 6) do crises periods affect liquidity creation?

In this study, we find evidence support (Acharya and Naqvi's, 2012) theoretical prediction that decreases in banks' funding liquidity risk as proxied by deposits leads to an increase in bank risk. We found a significant inverse relationship between banks' funding liquidity risk and bank risk-taking. In theory, a large flow of deposit funding encourages more aggressive lending at lower interest rates. In support of this, we find that an increase in deposit funding is consistently followed by an increase in banks' risk-weighted assets and liquidity creation. Moreover, an increase in deposit funding increases overall bank risk. The key empirical findings concern the risk determinants of liquidity financing and indicate that Jordanian banks with greater resources participate in riskier behavior than other banks.

Increased deposit financing also increases both the creation of liquidity and risk-weighted assets. High capital adequacy ratios, bank size, and high profits are also found to enhance banks' capacity to increase provisions and mitigate potential losses out of any financial shocks. The results show also that capital buffer and profit decrease liquidity funding risk which is broadly in line with previous results that confirm that well-capitalized banks with high-profit profiles are better protected against shocks, confirming (Jeitschko and Jeung, 2005). Macroeconomic instability in terms of high unemployment and inflation rates are also found to feed into higher bank risks. The DiD results show that banks with excessive deposits tend to have less liquidity funding risk after implementing the deposit insurance scheme, which in turn reduces the probability of bank "run". overall, bank size and capital buffers help to minimize the Jordanian commercial banks' risk-taking behaviour in response to decreased funding liquidity risk.

Jordanian commercial banks are more conservative even during the financial crises as they are monitored and controlled by the CBJ. Since 2000, the implementation of deposit insurance has not changed the negative relationship between bank capital and the creation of liquidity. The analysis provides robust evidence to support the negative relationship between capital and liquidity creation before and during the implementation of the Jordanian banking deposit insurance scheme. There seems to be a clear tradeoff between imposing bank capital requirements to maintain the financial system stability, and the process of liquidity creation to enhance banks' capital assets. This trade-off needs to be carefully considered when decision-makers and regulators design new policies or levy new measures on the Jordanian commercial banks. Our results in line with (Berger and Bouwman, 2009) and (Fungáčová et al., 2010) who find a negative impact from the capital on liquidity creation. A negative impact of capital on liquidity creation would the results suggest that greater capital requirements may hamper liquidity creation.

The ratio of total equity to total assets (CAP) is significant and positively correlated with RWA (credit risk). Size is also positively correlated with risk-weighted assets, the results are in line with the findings of (Boyd and Runkle, 1993), (Demsetz and Strahan, 1997), and (De Haan and Poghosyan, 2012). A significant robust positive relationship between loan and liquidity creation which is consistent with the findings of (Acharya and Naqvi's, 2012), NPL negatively affects liquidity creation. Loan is positively correlated with liquidity creation; thesis results suggest that the excessive lending behavior of Jordanian commercial banks increases

the chances of credit and default risks. In line with (Acharya and Naqvi's, 2012). Both ROA and ROE have a negative relationship with loan loss provisions and z-score. The results show that there is a significant negative relationship between loan, ROE, CAP, IRB and funding liquidity risk, which suggests that an increase in the capital buffer and profit will decrease the liquidity funding risk and are in line with previous results that confirm that well-capitalized banks with high-profit profiles are better protected against shocks (Jeitschko and Jeung, 2005). The results for the 3 sub-periods: before, during and after the global financial crises show that before the 2008 crises, size has a negative and significant impact on the Jordanian banking sector risk-taking (LLP and z-score). The results indicate that the larger Jordanian banks are safer and more stable in line with (Boyd and Runkle, 1993), (Demsetz and Strahan, 1997), and (De Haan and Poghosyan, 2012). During the global financial crises, NPL is shown to have a negative and significant impact on the Jordanian banking sector risk-taking (LC, RWA, and Z-score) behavior. Dep, ROE, and CAP are positively correlated with the Jordanian banking sector risk-taking (LLP). The results are explained by the fact that Jordanian banks with high capital buffers engage in much riskier activities. These results also correspond with the capital adequacy ratio (CAR) levels in the Jordanian banking sector which range between 18.0 percent and 21.0 percent during the years 2007-2015.

With regard to the liquidity financing risk model, the results show that, prior to the global financial crisis, the credit and CAP have had a significant negative impact on the liquidity risk of financing. While CAP maintains its negative relationship with liquidity financing risk during the global financial crisis. The results suggest that increasing capital buffer and bank profits decrease the liquidity funding risk after the global financial crisis.

CHAPTER 8

Concluding Remarks

8.1 Introduction

This chapter summarises and concludes this thesis. First a summary of the thesis is provided, followed by a discussion of the main findings of the three main chapters, the empirical findings of which fills the gap in the existing literature on the issues examined using Jordanian bank and other economic data. We then discuss the implications of this thesis with respect to how the Jordanian Central Bank (CBJ) and other policy makers improve and develop banking in Jordan. We proceed by briefly discussing the main limitations faced in completing this thesis and then provide directions for future research by focusing on two possible areas for research. The chapter concludes by providing a summary conclusion and highlight the main contribution made by the three chapters.

Commercial banks in Jordan are vital for financing other sectors. The turmoil in the MENA region and the eruption of the Arab Spring in 2010 and the Global Financial Crisis exacerbated the challenges that banks in MENA area face, including Jordan.The importance of the study is to investigate the impact of the reform program, Arab Spring, Global Financial Crises, and the Basel I, II and III on the Jordanian commercial banks during the 2003 and 2015. The research studied the 13 Jordanian commercial banks that listed in Amman Stock Exchange which they present 94% of the Jordanian banking system assets, the study covers the main driver banks in the Jordanian banking system in addition to the availability of the data that we need to the analysis purposes. The minimum CAR of the CBJ is 12% and the Jordanian commercial banks CAR reached 21% which give the importance to study the impact of the high CAR on the bank performance and the risk-taking behavior. One of the main reasons behind this investigation is the rare of the studies that examined the same topic in the Middle East in general and especially in Jordan. The study's findings are important as it give and highlight the impact of the new capital requirement regulations, liquidity risk, and risk-based capital regulation on the Jordanian commercial banks, which directly may help the CBJ regulators take the right and logical decision to improve and enhance the sector. It is helping the banks manager as well to take the right decision to minimize the banks risks.

Again, this study only focused on one aspect of banking sector indicators, which is a risk, and overlooked indicators related to productivity, efficiency, and profitability. Thus, there is a need for a comprehensive empirical assessment of the impact of the recent CBJ reforms on performance, risk, and efficiency indicators. This research is the first of its kind to cover an extended time span from 2003 until 2015 while considering the effects of some major incidences namely the 2008 global financial crises, Basel II and III accords announcements and regional political shocks such as the Arab Spring in the Middle East area and especially Jordan which makes a direct contribution to the existing literature by filling this gap in the Middle East area.

This thesis contains seven chapters, chapter one presents the introduction, chapter two provides a survey of the literature, and chapter three provides background on the development of Jordanian banking sector since 1990. The main empirical chapters that are the core of this thesis are chapter four, five, six and seven, the findings of which fill the gaps in the existing literature using Jordanian bank and other economic data. We used a sample of 13 commercial banks operating in Jordan's banking sector over the period 2003-2015.

8.2 Summary of the main findings

The main objective of the first empirical chapter, chapter 4 was to assess the effects of competition, risk, and market interest rate on Jordanian bank profitability. The methods of Pooled OLS, Fixed Effects (FE), Random Effects (RE), and Generalized Methods of Moments (GMM) approaches to aid our research strategy. The issues examined throughout this thesis is motivated by recent studies. Our study builds on the work of (Molyneux and Thornton, 1992 and Bikkera and Vervliet (2018), by extending the investigation to Jordanian commercial banks by incorporating more variables and in assessing the impact of competition, liquidity risk, and interest rate on bank profitability and risk-taking behavior. The study also makes use of more factors to show its effects on Jordanian bank profitability. We start our analysis by implementing the model of (Panzar and Rosse, 1987) which is based on a test statistic H, to assess the state of competition in the Jordanian banking sector. Both the FE and RE methods account for biasness in omitted variables that arise from ignoring the time-invariant characteristics correlated with the dependent variables and which cannot be accounted for. The GMM method is a dynamic modelling technique that permits the inclusion of lagged dependent variable as one of the right-hand side variables while accounting for the endogenous nature of

some of the variables by replacing them with their lagged and lagged differenced values. The findings of this chapter show the improvement of Jordanian commercial banks profitability and efficiency which is evidence that an increasing number of banks improved their competitiveness which ultimately impact bank performance, while also minimizing concentration (wherein the concentration ratio decreased from75 per cent to 53.9 per cent in 2015), decreasing the interest rate which, in turn, encouraged lending that affected investment activities positively. The findings also indicate a positive impact of competition on bank profitability, thus supporting the results of (Petria et al., 2015) who found a positive influence of competition on bank profitability. Liquidity risk was also found to have a significant positive impact on profitability which support the results of (Bourke, 1989) who found evidence of a positive relationship between liquidity risk and bank profitability. The results suggest that short-term interest rate has no significant impact on profitability and risk measures, thus supporting the findings of (Albertazzi and Gambacorta, 2009) and (Bikker and Hu, 2002).

The main goal of the second empirical chapters, chapter 5, was to examine the relationship between bank efficiency, capital, and risk of Jordanian commercial. This was important to understand the impact of capital requirements on the Jordanian bank efficiency and performance. We build on the contribution of (Tan and Floros, 2013) by examine the magnitude and direction of the dynamic relationships between bank efficiency/productivity, capital, risk. The two chapters use the pooled OLS, FE and RE methods previously discussed in addition to the Three-Stage Least Square (3SLS) method for chapter 5 which we use to estimate a system of equations that employ different risk indicators. This method has been used by (Tan and Floros, 2013) and (Rime, 2001). 3SLS is a remedy for the problem of endogeneity between bank efficiency, risk, and capital. Using 3SLS is that it provides consistent estimates of the parameters and is also a full information modelling technique that estimates all the parameters simultaneously and incorporates the cross-equation correlations and produces parameter estimates that are asymptotically more efficient than Two-Stage Least Square (2SLS). To calculate bank efficiency (Eff/O), I use the Malmquist Productivity Index (MPI) which uses distance functions to measure changes in productivity. I measure technical efficiencies using the non-parametric method, Data envelopment analysis (DEA) technique which has been used by Paul & (Kourouche, 2008) and (Alkhathlan and Abdul Malik, 2010a) among others. The empirical evidence suggests that risk harms capital and efficiency which supports the findings of (Demsetz et al, 1997), (Tan and Floros, 2013) and (Salas and Saurina, 2003), as well as the findings of (Stolz et al., 2004) and (Van Roy, 2005) and (Fungáčová et

al., 2014).

The main goal of the third empirical chapters, chapter 6, we examined the relationship between bank efficiency, competition on the cost of credit using data for 13 Jordanian commercial banks and 118 firms during the period 2003-2015. In the measurement of efficiency, we use the Data Envelopment Analysis (DEA) method. Unlike what was expected, the efficiency of the banking sector has no impact on firms' cost of credit, other determinants such as firm size, bank competition, and GDP are found to be the main moderatos of the borrowing costs. Our results are in line with (Fungáčová et al., 2014). The results show the favourable impact of the program and liberalization on the bank efficiency which improve the household and business to accesses credit. The results show no differences in findings regarding the impact of variables on the cost of credit for both large and small banks. The only difference found with the Tangibility as the variable shows a positive significant impact on the cost of credit in the large-sized firms while it is insignificant for small-sized firms. The positive relation explained as the Tangibility defined as the ratio of tangible fixed assets to total assets. A greater share of tangible fixed assets that could serve as collateral can contribute to easier access to credit and may indicate better opportunities for obtaining external financing

The main objective of the fourth empirical chapter, chapter 7, was to examine the impact of banks' funding liquidity risk on Jordanian commercial banks' risk-taking behaviour. This was important in order to understand the factors affecting Jordanian banking sector liquidity risk and capital. The issues examined throughout this chapter is motivated by recent studies. And we build on the contribution of (Khan et al., 2017) by investigating the relationship between funding liquidity and bank risk-taking and extend their study by looking at the impact of imposed Jordanian deposit insurance scheme. For this empirical exercise, I use the FE and RE estimation methodologies to empirically define the main determinants of the different risk measures of Jordanian commercial banks. The analysis undertaken is extended to determine the major factors of the banks' liquidity funding. I also use the Difference in Difference (DID) method to analyse the impact of the deposit insurance scheme implemented in Jordan in 2000 to gauge Jordanian banks' liquidity creation. In this respect, I compare changes in liquidity creation before and after the implementation of deposit insurance. The DID approach is usually used to estimate the effect of a specific intervention (deposit insurance scheme) by comparing the changes in outcomes over time between a group that is enrolled in a program and a group that is not. The empirical results show that Jordanian banks with larger capital engage in more risky actions than other banks. The results show that capital buffer and

profit decrease liquidity funding risk which is broadly in line with previous results that confirm that well-capitalized banks with high-profit profiles are better protected against shocks which is broadly consistent with the findings of (Jeitschko and Jeung, 2005). The results also show that before the global financial crises, loan and CAP have a negative significant impact on the funding liquidity risk. While during the global financial crises, CAP maintains its negative relationship with the liquidity funding risk, the study results show that bank size and capital buffers help to minimize the Jordanian commercial banks' risk-taking behaviour in response to decreased funding liquidity risk which is consistent with the findings of (Berger and Bouwman, 2009) and (Fungáčová et al., 2010) who find a negative impact from the capital on liquidity creation.

The findings of this study show liquidity risk to be one of the most significant risks that Jordanian commercial banks must mitigate against most of these banks rely on central bank guidelines to manage and set their liquidity and funding liquidity risk limits. The breadth of commercial banks' activities in Jordan as regards financing most of the economic sectors in the country through their role as financial intermediaries marks the importance of shielding them from liquidity risks. The thesis analyzed the impact of some factors such as profitability, capital, credit, size, competition. efficiency, risk, and other variables on the Jordanian banking performance and stability.

8.3 Research Contribution

The research contributes to the existing body of knowledge through providing a fair assessment of the impact of the reform program, the deregulation, and the new capital requirements on the Jordanian banking system performance, as to the best of the researcher's knowledge; very few studies have yet been concerned with the impact of new capital requirements framework in the MENA region in general and in Jordan specifically. This research will cover all Jordan commercial banks to investigating the impact of competition, risk, and interest rate on Jordanian commercial banks profitability, in addition to the relationship between Jordanian bank efficiency, capital and risk, and the relationship between funding liquidity risk and Jordanian bank risk-taking, capital, and size for the period between 2003and 2015. In additions, this research will enrich the existing literature of the techniques that could applied in other banks environments. The shape of this study could be helpful for the researchers in field of risk management studies and banking performance.

The outcome of the analysis shows that how the political volatility of the region and its impact on banks operations, commercial banks are using different metrics to set their exposures although the macroeconomic, regulatory and products are relatively the same, pointing to the level of risk appetite on which these banks operate and their dependency on the central bank in setting metrics for risks. Shedding light on the vulnerability of the banking system in Jordan to the political instability in the region, which impacts both macroeconomic and financial conditions. This is reflected in banks' risk appetites as most banks indicated that they are avoiding high-risk exposures to reduce their overall risk.

Therefore, this study is one of the first studies to present the impact of the capital requirements and risk-based capital within the population of commercial banks in Jordan and tests whether the reform program and deregulation is effective in commercial banks through employing a set of sub-hypotheses related to the main types of risks, such as liquidity and credit, risks. It also looks at liquidity funding plans that banks adopt based on their supervisory authorities' instructions. Furthermore, this thesis assesses the impact of various variables related to banking operations and the regulatory framework in Jordan, including the impact of macroeconomic conditions on Jordanian commercial banks' profitability, efficiency, and liquidity. The study deducts useful conclusions and recommendations that would help the banking industry to enhance banks performance and efficiency and help banks to develop a comprehensive and applicable framework tailored to the Jordanian banking system by identifying the main factors that impact profitability, efficiency, and liquidity risk.

The results indicate that internal factors have a major impact on the profitability, efficiency, and liquidity risk as the strategic plan of commercial banks impact the structure of banks' balance sheet and their operations, and thereby their liquidity positions and risk exposures. Therefore, having a consistent strategic plan that is aligned with the bank goals regarding maximizing profits and risk appetite, while mitigating against risk exposures, is imperative to control changes in these factors. For example, the results indicated that profitability had a positive impact on liquidity risk, which in the case of Jordanian banks should be warranted by the limited resources that banks have, their limited access to wholesale funding, and their reliance on conventional banking as their primary means of generating revenues. On the other hand, the importance of having efficient management who are able to set strategic plans and limits on risk exposures and risk appetite taking the regulatory and macroeconomic circumstances in Jordan into consideration.

To the best of my knowledge, the study found no previous research on Jordanian banking covers the main objectives of this study. Overall, the empirical work presented in these chapters fills an important gap in the empirical literature by investigating the impact of competition, risk and interest rate on Jordanian commercial banks profitability, in addition to the relationship between Jordanian bank efficiency, capital and risk, and the relationship between funding liquidity risk and Jordanian bank risk-taking, capital, and size for the period between 2003and 2015 which should help to inform policy makers on how to move forward, with respect to policy measures, to improve the environment in which Jordanian banks operate.

8.4 Policy Implications and Recommendations

The results of this study provide some implications for policy-makers, banks shareholders, academics, as well as, regulatory institutions such as the central bank of Jordan. Central banks in countries with a similar banking sector may find the results useful for drafting regulations and policies related to liquidity risk management in commercial banks. This would help to safeguard the banking sector by encouraging banks to develop guidelines for bank performance (profitability, efficiency and liquidity risk) that promote transparency in risk management. Regulators could also use this study to set guidelines built on the recommendations of the Basel committee. If shared with other research, the general findings in this study will have remarkable implications in improving the bank's performance and chart up risk's identifications for financial institutions.

The main conclusions of the research clearly show that internal factors have the biggest impact on bank profitability, efficiency, and liquidity risk. As the Jordanian commercial banks are concerned with meeting the liquidity requirements set by the central bank. This is an indicator of the comprehensive framework for liquidity management at commercial banks given the limited resources. This highlights the importance of the regulatory body to help banks construct a framework for liquidity management that takes a holistic approach to dealing with transparency in risk management, proper delegation of authorities, adequate reporting, and funding sources. Such frameworks should be a part of the strategic plans and targets set by banks. It is hard to set out one best strategy for liquidity management – but multi strategies can be adopted to achieve banks goals in profit and growth and enhance commercial banks' abilities in managing their liquidity positions and risks. It is worth to point out the growth in banks' balance sheet is crucial, it needs an appropriate framework to support this growth and minimize the risks. Therefore, banks' risk-taking behaviour strategies should be organised with other risk

plans implemented first followed by banks goals to support and ensuring banks sustainable growth. Accordingly, the main recommendations from the thesis can be summarized as follows:

Clear framework for liquidity risk management: The Jordanian commercial banks should ensure the consistency of their liquidity management frameworks with the strategic objectives of operational divisions, considering the asset and liability structures, capital positions and liquidity on different stages. The liquidity risk framework is extremely important from the viewpoint of ensuring the soundness and suitability of banking system, and the bank management is responsible for taking the initiative in the chart up a clear liquidity risk management framework and reviewing occasionally whether the framework is appropriate to the bank risk profile (such as liquidity, interest rate and credit risk), and the nature of its business.

Enhancing coordination between banks and supervisory authorities: Supervisory authorities, represented by the central bank in Jordan, have taken a keen interest in supervising financial institutions' liquidity positions as well as liquidity risk levels, especially after the Global Financial Crisis, which urged the Basel committee to issue the Basel III guidelines that are mainly concerned with liquidity management. These changes have increased the regulatory burden on the central bank and increased banks' reliance on its guidelines with regards to liquidity, as shown by the study results. Accordingly, banks could still be lacking a comprehensive framework related to liquidity risk management. Therefore, increased coordination between banks and central banks is needed through establish systems for assessing and measure risks. The study results indicated that the new regulations and the liberalization processes are effective in most Jordanian commercial banks, as supported by the results of the sub-hypotheses. Still, some actions should be taken to insulate banks from liquidity risks and improve profitability and efficiency, taking into consideration the political instability in the region and its impact on the macroeconomic conditions. Therefore, the supervisory authorities, represented by the central bank, should take into consideration the results of this study given the emphasis of Basel III on liquidity management.

Besides, this thesis have some important policy implications for the Amman stock exchange (ASE), Jordanian banking regulatory authorities, the CBJ regulators and bank managers, as it provides rigorous empirical investigations of profit, efficiency, and risk exposure determinants of the Jordanian banking sector. Our findings should steer policymakers towards designing appropriate and fair regulations to enhance bank performance while at the

same time ensuring the stability of the Jordanian financial system. The findings of chapter five and six should encourage bank managers and regulators to enforce tighter restrictions and to apply effective risk management practices to ensure financial stability and mitigate potential losses of any internal or external shocks. The CBJ reform phases and the introduction of the deposit insurance scheme both carried favorable spillovers on the competitiveness, profitability, and stability of the banking sector, however extra efforts are still required to enhance the competitiveness of the banking sector and the development of the Amman stock market.

Chapter four investigates the impact of competition, liquidity risk, and market interest rate environment on Jordanian banks' profitability results, suggesting that the structure of the Jordanian commercial banking industry was characterized by monopolistic competition. This result may reflect the domination of the Jordanian commercial banking sector by 3 large banks, which together account for over 75 percent of total banking assets. The large banks tend to avoid outright competition against each other. The challenge for Jordanian banking sector authorities is to ensure that the ongoing reforms result in greater competition and welfare gains for the economy. Therefore, motivating the competitive environment in the market will eventually lead to more efficiency. The results show that there is still a need to enhance market competition, the positive change in the competitiveness state of the Jordanian banking sector corresponds to the entry of six new banks meaning that minimizing the entry of new banks restrictions to the Jordanian banking sector will improve the competition and reduce the concentration. Careful management is required for the larger number of deposits and the acquired capital by Jordanian banks due to the inward migration of Iraqi and Syrian refugees to Jordan. more restrictions on the liquidity and capital ratio needed as they protect Jordanian banks against future shocks. As a result, Jordanian banks should start to use a wide range of products and services to improve banks' profitability and become less reliant on interest income as a result of the low-interest-rate environment. The government should, therefore, desist from controlling prices and allow the functioning of market forces. On the other hand, in the highly concentrated markets, uncertainty avoidance or risk aversion rather than efficiency become the objectives of some banks. Market power (lack of competition) can thus lead to reduced efficiency. The policy implication for this result suggests that mergers between banks could strengthen the market power. With a high degree of concentration, it is possible that the "quiet life" hypothesis will come into play in Jordan. That is, as firms enjoy greater market power and concentration, inefficiency follows not because of non-competitive pricing but more so because

of a relaxed environment with no incentives to minimize costs. Thus, if the market concentration is leading to lower efficiency, the government policy of encouraging the bank mergers between banks needs to be approached with caution. it supports the favorable spillovers of the reform policies on the overall profitability and efficiency of the Jordanian banking sector. However, chapter four empirical results confirm the low competitive nature of the banking sector and stress the need for enhancing market competition. The results also suggest that higher total banks' assets may not necessarily lead to higher profits and that careful management by bank managers is required due to the unexpected booming in the number of deposits and capital by Jordanian banks due to the inward migration of Iraqi and Syrian refugees to Jordan. The unplanned escalation in bank capital may encourage bank managers' risk-taking behaviour and enhance the chances of bank default.

In Chapter five and six, we analyze the relationship between bank efficiency/productivity, capital, risk, and cost of credit. DEA results suggest there is improving bank efficiency in Jordanian commercial banks. The factors that may influence efficiency have been identified in this study and could aid banks and policymakers in devising suitable strategies. Inconsistent with the above results, First, large banks are found to be more efficient than small banks. Therefore, small banks should be encouraged to become larger. Second, banks' profitability is positively related to efficiency. Third, market power plays an important role in inefficiency. Therefore, motivating the competitive environment in the market will eventually lead to more efficiency. Fourth, the significance of capital adequacy ratio in explaining efficiency implies that banks with higher capital adequacy ratio are less efficient since they are risk-averse and prefer safer and lower-earning portfolios. Finally, and more importantly, the liberalization is positively related to efficiency, suggesting that a further liberalization in the market will eventually lead to more efficiency in the Jordanian banking sector. The results show that improving the competitiveness of the banking sector is one dimension that requires the attention of bank regulators as it was found to be a significant factor in improving capital and efficiency measures and reducing risks in the Jordanian banking sector, in addition to contributing significantly to better access to credit by lowering financing obstacles for firms.

Chapter seven studies the impact of banks' funding liquidity risk on the Jordanian commercial banks' risk-taking behavior. It shows that bank size and capital buffers help to minimize the Jordanian commercial banks' risk-taking behaviour in response to decreased funding liquidity risk. Also, the introduced deposit insurance scheme has reduced the need for

liquidity funding risk for banks with excessive deposits. Policymakers and bank managers need to carefully address the tradeoff between imposing bank capital requirements to maintain the financial system stability, and the process of liquidity creation to enhance banks' capital assets. This trade-off needs to be carefully considered when designing new policies or levy new measures on the Jordanian commercial banks. Jordanian commercial banks are more conservative even during the financial crises as they are monitored and controlled by the CBJ. Implementing deposit insurance since 2000 has not changed the negative relationship between bank capital and liquidity creation. There seems to be a clear tradeoff between imposing bank capital requirements to maintain the financial system stability, and the process of liquidity creation to enhance banks' capital assets. This trade-off needs to be carefully considered when decision-makers and regulators design new policies or levy new measures on the Jordanian commercial banks. The results support the view that the Jordanian banks should improve the quality of their assets and reduce their riskiness. The findings of this study show that capital buffers and size generally help to curb banks' risk-taking behavior in response to decreased funding liquidity risk. The results may help regulators redesign the banking regulatory framework such as (stress analysis) to better discipline and control the perverse incentives of bank managers to take too much risk when bank deposits change.

8.5 Research Limitations

Although this thesis conducted a study of commercial banking in Jordan, consisting of three core chapters, in an in-depth manner, the completion of the thesis was not without its specific limitations. This research has the following limitations:

1. Limited population: The Jordanian economy is a small open economy with a banking sector comprised of 21 commercial banks and many of Islamic banks. Therefore, this is a limited population to study.
2. Data limitations: There are 21 commercial banks in Jordan. Thirteen are domestic banks and the rest are foreign banks branches. In this part of the study, the analysis only included the 13 domestic commercial banks as data for the rest of the population could not be obtained through the used database or through manual data entry. Moreover, the small-time span of the data is considered another limitation that led to having a relatively small dataset.
3. Lack of prior research studies: According to the best of the researcher's knowledge,

very few studies have investigated the impact of internal factors profitability, efficiency, and risk at Jordanian commercial banks. And very few studies have yet studied the impact of new capital requirement and risk-taking behavior.

4. Longitudinal effect: Compared to the long history of literature on bank management in both a global as well as domestic context, this research was carried out over a fairly short period of time.

The major limitation was its focus on a limited number of commercial banks in Jordan covering the period 2003-2015, which means that time does not consider the effects of the historical financial crisis during the 1980s. Regarding some relevant control variables such as risk-weighted assets and NPL, we were unable to locate sufficient data for these variables especially before 2006 to incorporate them in our models. However, despite the limited data, the three Chapters that form the core of the thesis has produced a significant empirical study that contributes towards filling the gap in the literature on the behavior of Jordanian banks, which should be of some help to bank managers, the CBJ, foreign investors, bank regulators and Jordanian policy makers interested in obtaining better understanding of modern day developments, including the impact of policy changes, and the changing market environment on Jordanian commercial banks.

8.6 Directions for future research

Within the confines of this thesis, there are two areas of potential extensions to the issues studied that have emerged during our study of Jordanian banking. In our earlier discussion in Chapter 3 on the developments in Jordanian banking, we noted that the CBJ implemented a series of measures to improve the overall performance of the banking sector, including measures based on best practices in corporate governance. Therefore, it would be of interest to investigate the extent to which corporate governance initiatives' performance has affected the performance of Jordanian banks over the period in which corporate governance measures began to take effect. According to the corporate governance literature, successful corporate governance structures can improve not only public accountability, but it can also create value, enhance operational efficiency, while also minimizing risk exposure. Empirically, this line of inquiry could be approached by the application of two common approaches – the parametric stochastic frontier approach and the non-parametric data envelop analysis, using the theory of agency and a set of governance related data. This line of research would also be of some

interest to regulators and policy makers and other MENA countries where corporate governance reforms are on the increase.

A second important issue for further research which follows from our findings reported in Chapter 6 concerns the risk preference of Jordanian commercial banks. In regard to this, it would be of interest to ascertain which categories of risk preferences best categorise Jordanian commercial banks – conservative, moderate or aggressive, especially given the general consensus in Jordan which holds that Jordanian commercial banks are conservative in their banking practices. Thus, it would be of interest to confirm whether such views hold empirically by examining banking efficiency with risk factors taking the risk preferences of Jordanian banks into account. Statistically, this could be approached by, in the first instance, a profit model using common profit-based variables to study the risk preferences of Jordanian banks. Second, a credit model which could be used to determine whether low risk cost affects the risk preferences of Jordanian commercial banks.

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Appendixes

Appendix A: The Commercial Banks Name

Appendix 1: The Commercial Banks Name

Bank Name
ARAB BANK
THE HOUSING BANK FOR TRADE AND FINANCE
JORDAN KUWAIT BANK
JORDAN AHLI BANK
BANK OF JORDAN
CAIRO AMMAN BANK
ARAB BANKING CORPORATION /(JORDAN)
BANK AL ETIHAD
CAPITAL BANK OF JORDAN

JORDAN COMMERCIAL BANK
SOCIETE GENERALE DE BANQUE - JORDANIE
ARAB JORDAN INVESTMENT BANK
INVEST BANK

Appendix 2: The Firms Size and Sector.

Firm Name	Sector	Size (Total Assets)	Firm Name	Sector	Size (Total Assets)
JORDAN CHEMICAL INDUSTRIES	Industrial	6556000	JORDAN TRADE FAC	services	38273000
JORDAN COM	Industrial	1482983000	JORDAN VEGETABLE OIL	Industrial	6282000
JORDAN DAIRY	Industrial	11602000	JORDAN WOOD INDUSTRIES / JWICO	Industrial	13786000
JORDANIAN ELECTRIC	Industrial	898442000	JORDAN WORSTED MILLS	Services	76423000
JORDAN HOTELS	Services	34924000	JORDAN INDUSTRIAL	Industrial	19292000
JORDAN INTER TIO L	Industrial	8915000	JORDAN PETROLEUM REFINERY	services	1270420000
JORDAN INVESTMENT	Services	32902000	JORDAN CEM	Industrial	174190000
JORDAN INTERNATIONAL SHIP	Industrial	35853000	JORDAN EXPRESS TOURIST TRANSPORT	services	21776000
JORDAN PIPES MANUFACTURING	Industrial	7370000	ITTIHAD SCHOOLS	services	25752000
JORDAN POULTRY PROCESSING & MARKETING	Industrial	62713000	INTERNATIONAL POULTRY PLC	Industrial	8571000
JORDAN PROJECTS FOR TOURISM DEVELOPMENT	services	120756000	NUTRI DAR	Industrial	13187000
JORDAN STEEL PLC	Industrial	67812000	PHILADELPHIA PHARMACEEUTICALS	Industrial	10351000
JORDAN TELECOM	services	573926000	SOUTH ELECTRONICS	services	20495000
AL EQBAL INVEST	Services	108235000	MASAFAT FOR SPECIALISED TRANSPORT	services	30343000
AL-RAKAEZ INVESTMENT CO.	services	13361000	MIDDLE EAST INSURANC	Services	78022000
ARAB EAST FOR INVEST	Services	73266000	INTERNATIONAL CHLORINE	Industrial	19043000
ARAB INTERNATIONAL	Industrial	75158000	INTERNATIONAL PORTFOLIO	Services	11701000
ARAB PHOENIX HOLDING	Industrial	92822000	INTERNATIONAL STEEL INDUSTREAL	Industrial	6251000
ASSAS FOR CONCRETE PRODUCTS CO. LTD	Industrial	15790000	OFFTECHOLDING GROUP PLC	services	54666000

ELZAY READY WEAR	Industrial	20021000	PHILADELPHIA INTERNATIONAL EDUCATIONAL INVESTMENT	services	33246000
HAYAT PHARMACEUTICAL INDUSTRIES CO.	Industrial	18236000	PREMIER BUSINESS AND PROJECTS CO.LTD	Industrial	6815000
INDUSTRIAL COMMERC	Industrial	25912000	REAL ESTATE DEVELOP	Services	60914000
INTERMED PETRO CHEM	Industrial	10802000	SAFWA ISLAMIC BAN	Services	779166000
IRBID DISTRICT ELECTRICITY	services	257004000	SPECIALIZED TRADING & INVESTMENT	services	1616000
JORDANIAN DUTY-FREE SHOPS	services	8400000	SPECIALIZED INV	Services	28225000
THE JORDANIAN PHARMACEUTICAL MANUFACTURING	Industrial	48283000	CONSULTANT AND INV	Services	15679000
AFAQ FOR ENERGY CO. P.L.C	services	302490000	JORDAN VEGETABLE OIL INDUSTRIES	Industrial	3499000
JORDAN PHOSPHATE MINES	Industrial	1167093000	JORDAN MARBLE COMPANY P.L.C.	Industrial	8238000
COMPREHENSIVE LEASING COMPANY PLC	services	32395000	JORDAN PAPER & CARDBOARD FACTORIES	Industrial	13611000
UNITED CABLE INDUSTRIES	Industrial	52068000	JORDAN PRESS FOUNDATION/AL-RA'I	services	11170000
AL BIL	Industrial	44184000	JORDAN SULPHO-CHEMICALS	Industrial	11058000
AL QUDS READY MIX	Industrial	10005000	COMPREHENSIVE	Services	47706000
ARAB ELECTRICAL INDUSTRIES	Industrial	8786000	MODEL RESTAURANTS CO	Services	18203000
INTERNATIONAL CABLE	Industrial	34153000	ALAHLIA FOR PROJECT	Industrial	91009000
ARAB INTER TIO L	Industrial	118644000	INTERNATIONAL CERAMIC	Industrial	8947000
READY MIX CONCRTE AND CONSTRUCTION SUPPLIES	Industrial	56386000	RUM ALADDIN INDUSTRIES	Industrial	13250000
JORDAN COM	Industrial	1482983000	TRUST INTERNATIONAL TRANSPORT	services	544000
RUM GROUP	Services	21730000	UNION ADVANCED INDUS	Services	14170000
JORDAN CERAMIC INDUSTRIES	Industrial	1948000	UNITED ARAB	Industrial	355151000
TRANSPORT& INVESTMENT BARTER COMPANY	services	20068000	SALAM INTERNATIONL TRANSPORT & TRADING	services	50752000
UNION TOBACCO & CIGARETTE INDUSTRIES	Industrial	74570000	SPECIALIZED JORDANIAN INVESTMENT	services	4106000

UNION INVESTMENT	Services	150518000	AKARY FOR INDUSTRIES AND REAL ESTATE INVESTMENTS	Industrial	726000
UNION LAND DEVELOP	Industrial	65395000	AL DAWLIYAH FOR HOTE	Services	61989000
ZARA INVESTEMENT HOLDING	services	220599000	AL TAJAMOUAT FOR	Industrial	9073000
AD DULAYL INDUSTRIAL	Industrial	43491000	RUM GROUP FOR TRANSPORTATION & TOURISM INVESTMENT	services	21730000
AL ISRA FOR EDUCATIO	Services	45797000	UNIVERSAL MODERN INDUSTRIES	Industrial	11146000
AL FARIS TIO L IN	Industrial	30118000	ALJANOUB FILTERS	Industrial	3825000
AL TAJAMOUAT	Industrial	150128000	AMA AGRIC	Industrial	6226000
ALIA- THE ROYAL JORDANIAN AIRLINES PLC.	services	433066000	COMPREHENSIVE MULTIPLE PROJECT COMPANY	Industrial	12018000
ARAB FOR INVESTMENT	Services	9521000	INVESTMENTS AND	Services	30103000
ARAB EAST FOR REAL	Services	39961000	MIDDLE EAST SPECIALIZED CABLES COMPANY /MESC_JORDAN PLC	Industrial	29482000
BINDAR TRADING & INVESTMENT CO. P.L.C	services	39433000	ARAB CENTER FOR PHARM.& CHEMICALS	Industrial	7324000
COMPREHENSIVE LAND	Services	10851000	FIRST INTERNATIONAL	Industrial	10088000
DAR AL DAWA DEVELOPMENT & INVESTMENT	Industrial	90523000	INVESTMENT HOUSE	Services	7071000
EMMAR INVESTMENTS	Services	22824000	AL-QARIA FOOD & VEGETABLE OIL INDUSTRIES CO. P.L.C	Industrial	13695000
INTERNATIONAL ARABIA	Industrial	7253000	DARWISH KHALILI	Industrial	52780000
INTERNATIONAL BROKER	Services	22798000	MIDDLE EAST PHARMA. & CHMICAL IND. & MEDICAL APPLIANCES	Industrial	19062000
INTERNATIONAL CO	Industrial	22798000	MIDDLE EAST COMPLEX FOR ENG., ELECTRONICS & HEAVY	Industrial	423031000